the OIL AND GAS JOURNAL

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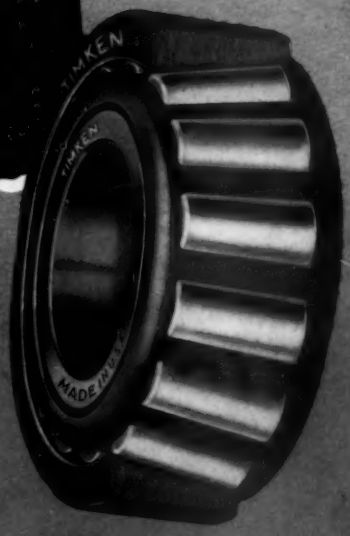

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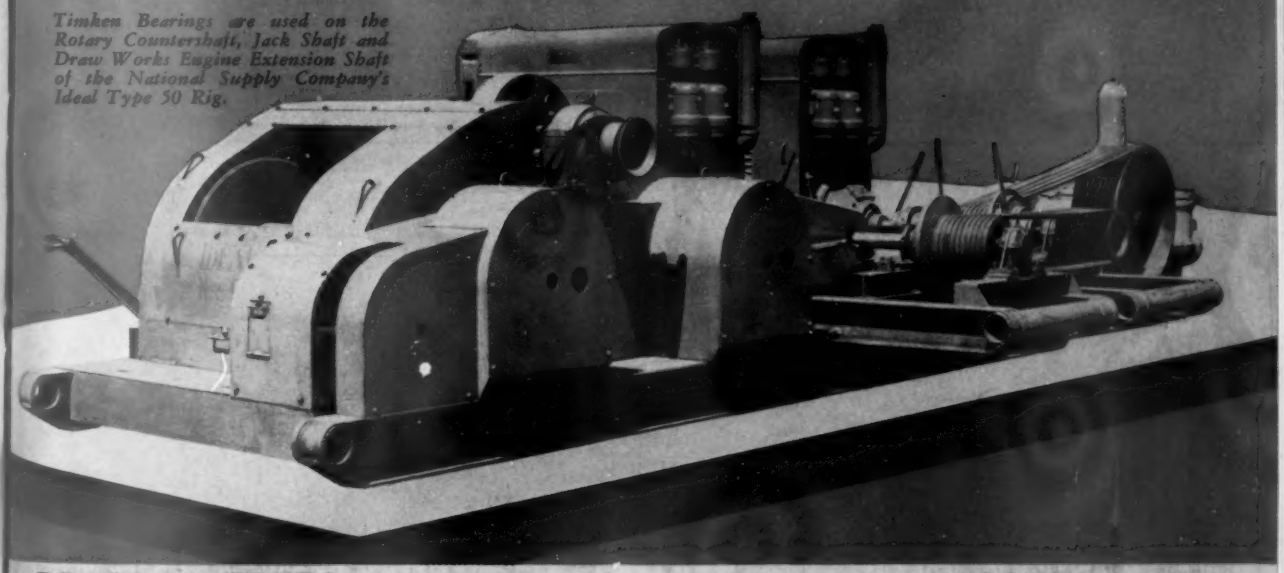

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Trends

Crude-Oil Production
By States—Page 102

CRUDE-OIL STOCKS 220,060,000 bbl. as of February 17—up 1,166,000 bbl. One year ago 237,511,000 bbl.

GASOLINE STOCKS 94,680,000 bbl. as of February 17—up 2,225,000 bbl. One year ago 83,302,000 bbl.

RESIDUAL FUEL-OIL STOCKS 48,240,000 bbl. as of February 17—down 605,000 bbl. One year ago 52,694,000 bbl.

GAS OIL AND DISTILLATE STOCKS 29,864,000 bbl. as of February 17—down 680,000 bbl. One year ago 33,914,000 bbl.

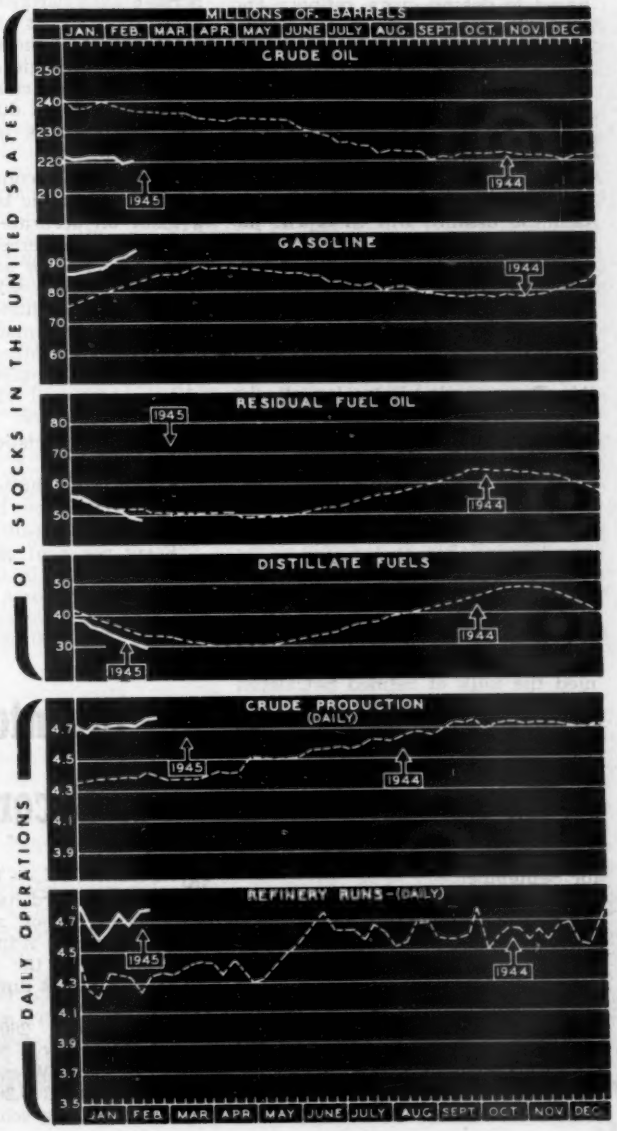
CRUDE OIL PRODUCTION 4,777,250 bbl. as of February 24—up 8,250 bbl. One year ago 4,387,435 bbl.

REFINERY RUNS 4,787,000 bbl. daily week ended February 17—up 17,000 bbl. One year ago 4,441,000 bbl.

AT a recent meeting many oil men, including refinery operators, expressed surprise when it was pointed out that current production of natural-gasoline plants, cycling plants and allied operations exceeded the total production of all gasolines during the last year of World War 1. Had the figures been at hand at that time it could have been explained that the output of these light products in December 1944 (the latest available) was greater than the national production of all gasolines as late as 1920. In fact, the production of natural gasoline and associated products last year, totaling slightly more than 100 million barrels, was 35 per cent of the output of crude oil in 1918. This 1944 output came largely from more than 400 natural-gasoline plants in 16 states and from 40 cycling plants which were operating or under construction early last year.

THE natural-gasoline manufacturer and cycling operator have fitted into the emergency petroleum operations wherever they could "as we do in peacetimes," according to the explanation of one large manufacturer. This statement reflects the fact that in the opinion of some manufacturers their contribution to the war effort would have been more outstanding had government officials in the early days of preparation given consideration to the new processing possibilities. Be that as it may, a look at the weekly sales report of one of the large manufacturers leaves no doubt as to the size and importance of today's operations which total more than 300,000 bbl. daily. These sales extend from propane, of the L.P.G. operations, to the light distillates which are cracked and reformed into aviation gasoline components at refineries. Butanes, butylenes and other hydrocarbons are large sources of charging stock for other war-product operations including the manufacture of butadiene.

THE operators of these plants in addition to maintaining maximum output currently, are giving serious thought to what their position will be in postwar operations. They are determined to avoid the situation of the late thirties in which their principal product sold for less than crude oil throughout the Southwest. The problem is being approached from the standpoint of expanding existing markets, new processing methods and lower transportation costs.



Air Destruction of Nazi Oil Supply Disclosed by Arnold

WASHINGTON.—The part played by the U. S. Army Air Forces in destroying German oil resources was described in considerable detail in the report of Gen. H. H. Arnold, commander of the AAF, made public this week.

The report described the work of the AAF in all theaters during the past year, but referring particularly to the attacks on German oil installations it says:

"After the spring air victories over the aircraft factories, the U. S. Strategic Air Forces in Europe had a special target—oil. Hitler was prepared to defend every refinery and synthetic plant with all the defensive devices at his command. He was prepared to divert labor and material from any other source to the quick repair of oil plants.

"For some months previously neither American nor British bombers had made an all-out effort against oil. We lacked the capacity to sustain the assault. But in April, the Fifteenth Air Force attacked the Ploesti refineries in Romania in considerable force. On May 12 the Eighth Air Force made its first large-scale bombardment of synthetic production in Germany. From May through September the Eighth Air Force made six major attacks on 32 plants and refineries. The Fifteenth Air Force bombed 41 oil plants and refineries. RAF Bomber Command made night and day attacks on oil. What was accomplished?

Denied Ploesti Oil

"We know from first-hand observation and Romanian records that when Soviet forces occupied Ploesti in August, the Nazis had been denied the bulk of refined petroleum products from the area.

"We know that because of the Eighth Air Force's six great operations from May 12 to September 12, the bombing and loss of Ploesti, and RAF attacks on oil plants in Germany, the production of German oil was reduced 75 per cent for September.

"We know that streetcars are hauling coal and bricks through German cities because of lack of fuel for other transport. Military vehicles are being fitted to run on producer gas. Luftwaffe fighter pilot training has been curtailed to conserve oil. Men of German aircraft servicing crews have been court-martialed for spilling a liter of gasoline. Railroads have been utilized to an amazing extent for short-haul freight. In Hamburg there is no gasoline at all for civilian vehicles. The Germans, certain their oil plants will be bombed, haul brick, steel, gravel, and glass around the plants and install organized repair crews in barracks nearby, so not an hour shall pass after the last bomb has fallen until workmen are swarming over the wreckage getting it under repair.

"We know that lack of oil played an important role in the battle of France. Tanks were abandoned for lack of gasoline. Troops moved in horse-drawn carts and by foot because their trucks had no fuel. How much of this shortage was occasioned by strategic curtailment and how much was caused by tactical destruction of oil dumps and transport and bridges is impossible to estimate.

"Again, as we continue the attack on oil by strategic bombing, we are without an accurate yardstick. We are dealing in percentages and figures and tonnages and photographs. We can estimate what the curtailment of oil production is doing to the enemy's war machine and check it against observations on the battle fields. We feel confident the results will measure well when laid against the final yardstick.

"The final yardstick is the battle of Germany."

In discussing the work of the Fifteenth Air Force based in Italy, General Arnold said:

"Forty per cent of Adolf Hitler's oil has gone up in the fires set by Fifteenth Air Force bombers. His war machine once consumed 1,400,000 tons (9,800,000 bbl.) of fuel (gasoline and oil) per month. One half of that came from the Romanian oil fields and synthetic oil refineries in southeastern Europe and Balkans.

"With enemy air opposition decreasing, the Fifteenth Air Force was able to put its full strength into the campaign. Since last April, when the campaign began, the German fuel supply has been cut by approximately 564,000 tons a month in attacks on oil refineries in Romania, Austria, Hungary, Czechoslovakia, Poland, Germany, and Yugoslavia.

New Tactics Devised

"One third of the German oil supply came from the rich fields of Romania with the center at Ploesti. Protected by 250 heavy guns, interceptor nets and smoke screen, it was the third most heavily defended target on the continent.

"To penetrate these defenses, new tactics had to be devised. A straight drive at the target started an aerial battle that would weaken defenses on succeeding days. The fighter opposition was drawn off by diversions. On one such occasion P-38 Lightnings flew one of their longest missions in the European war. The campaign steadily reduced fighter opposition, but flak and smoke screens were still formidable. The smoke screens were overcome by instrument bombing and by reconnaissance pilots who preceded the bombers over the target and radioed the information which enabled the bombers to hit targets covered by smoke.

"Ploesti was finally knocked out in a 3-day assault in August. In 23 attacks, 19 of which were by the Fifteenth Air Force, the bulk of its production had been denied to the Nazis. The cost was 2,277 airmen lost and missing and 270 aircraft. A conclusion to the operation was to be found in the return of 1,000 missing airmen from Bucharest, some riding in the same Flying Fortress that 12 days before had taken part in the last Ploesti mission."

Inventory Must Supply Part of Second-Quarter Steel Needs

WASHINGTON. — The War Production Board has allotted 511,500 tons of carbon and alloy steel to the Petroleum Administration for War for use by the oil industry in the United States during the second quarter of 1945.

This includes 260,130 tons for manufacture of oil country tubular goods, which PAW estimates will be sufficient to drill 6,260 wells. Since the PAW drilling schedule calls for 6,900 new wells in the second quarter, an attempt will be made to draw on inventories for tubular goods to the extent of 10 per cent of the new goods being manufactured, thus meeting full PAW request for 287,000 tons for tubular goods.

WPB gave the oil industry 331,000 pounds of aluminum for the second quarter, the full amount requested, and 5,245,000 pounds of cop-

per, only slightly below the request.

In order to meet the critical steel situation which exists at the present time, the War Production Board has appointed an emergency committee to review the entire supply and demand situation for the second and succeeding quarters of this year, with a view to making recommendations to assure that all essential requirements will be met.

In emphasizing the seriousness of the current supply situation, WPB representatives pointed out that during January steel production was 350,000 tons less than expectations due to weather conditions, the fuel shortage, and other problems. It was also pointed out that sharp revisions in military procurement schedules resulted in the issuance of special directives to many steel mills, causing some sharp dislocations of production schedules.

Members of the industry committee were informed by WPB officials that the second quarter supply picture is particularly critical with respect to quality steels, seamless pipe and tubes and other products. These particular items are receiving special attention from the WPB and the military. The Army is reviewing its requirements for these products for the second and subsequent quarters with a view to determining if new facilities are needed for their production.

Revised Procedure Outlined for Deferment of Key Oil Personnel

by Henry D. Ralph

WASHINGTON. — Procedures under which a limited number of key personnel under 30 may be certified for deferment were announced this week by Deputy Petroleum Administrator Ralph K. Davies. The routine, Davies said, had been worked out in accordance with the plan approved by the Office of War Mobilization and Reconversion and announced this week by Selective Service headquarters.

Up to 30 per cent of essential key employes between 18 and 30 years of age may be certified for deferment by PAW, but certifications will be made on the basis of information furnished to PAW by employers, and allocation between plants and between occupational groups will be determined by PAW. Information required from employers includes three separate forms, personnel list, an occupational list, and selective service Form 42A, special revised.

Personnel list required should list all employes by name who are under 30 years of age and who were, on January 1, 1945, classified by their draft boards as 2A or 2B. The names are to be in order of the employer's preference, with the men most urgently needed at the top of the list. Certifications will be made in that order. Employers were urged by Davies to be sure to list all men classified, since this will determine the number of certifications PAW will grant. This list should be furnished separately by state where employes are located for each industry branch, except in the case of refineries, natural gasoline plants and other industrial establishments which should prepare a separate list for each establishment rather than by state. Drilling contractors and geophysical firms, whose employes travel about, should submit separate lists for each state in which the employer maintains payroll records. In either case, employers were urged by PAW to weigh the relative importance of employes under 26 now deferred against men between 26 and 30 whom they may wish deferred. Younger men already deferred, PAW pointed out, will have to be reconsidered.

The occupational list is required of firms employing more than 10 persons, and will cover the same information as the personnel list, but will make it possible for PAW to evaluate the needs for deferment within any occupational group in the 18-29 age bracket. The occupational list totals men in each field for whom deferments are desired, not specific employes.

Both these lists must be submitted, in quadruplicate, to the Manpower Counselor, PAW, Washington 25, D. C.

The first two lists should be filed immediately, Davies said, although selective service form 42A will not be available for a short time. The latter will be obtained through draft boards.

Conditions of eligibility, as spelled out by PAW, indicate a strict policy of granting certifications only to indispensable men in strictly defined key positions. Significantly, deferments will not be granted for men engaged in work connected with postwar activities.

The criteria for certification include the following:

Only a limited number of men under 30 can be certified. No man can be certified unless he is doing work indispensable in an activity included within the War Manpower Commission list of essential activities.

Moreover, no such indispensable man can be certified if he can be replaced from less essential work within the plant or by recruitment from without. A man will be considered replaceable if a recruit or transferee can be qualified to perform his work after 3 months of intensive training.

Power of Local Boards

Men engaged in planning, research, development or production for postwar purposes shall not be certified for deferment.

Selective service officials emphasized that Form 42A may be filed with local draft boards even though certification has been denied by a government agency. Local boards may grant or deny deferment requests on their own judgment, but they are instructed to give certified requests the most serious consideration.

Under the new regulations registrants of the ages 30 through 33 to be eligible for deferment must be "necessary to and regularly engaged in" an activity in war production or in support of the national health, safety or interest.

Concerning registrants of the ages, 34 through 37, the Selectice Service memorandum states:

"Merely the determination is required that the registrant is 'regularly engaged in' an activity in war production or in support of the national health, safety or interest."

The new provisions do not modify the right of appeal, PAW said. Further, employes should file appeals in the regular manner for employes reclassified and called up before the new Forms 42A are available and this procedure goes into effect.

PAW will begin mailing complete instructions and forms for the personnel and occupational lists within a few days.

Oil Operations Resumed in Romania on Limited Scale

The oil industry in Romania has been able to resume operations on a limited scale, according to Petroleum Press Service, which says the industry suffered little damage "because the Red Army advanced too swiftly and Romanian forces did their best to prevent destruction that might have been planned." Excluding Soviet Russia, Romania is the largest producer of crude oil on the European continent. Standard Oil Co. (N. J.) and Socony-Vacuum Oil Co., Inc., hold extensive interests in that country.

Application Made for 1,085-Mile Hugoton-Detroit Gas Line

WASHINGTON. — Federal Power Commission has received an application by American Light & Traction Co. for a certificate to construct and operate a 1,085-mile natural-gas pipe line of 26 and 22-in. diameter to extend from a point in the Hugoton gas field near Guymon, Okla., to points near Detroit and Toledo. From Detroit the line will extend about 140 miles to the Austin gas storage field in Mecosta County, Michigan. It will be equipped with compressor stations to provide a daily capacity of about 145,500,000 cu. ft. of natural gas.

Cost of the project is estimated at $51,500,000. It is intended to begin actual construction not later than May 1, 1945, and to complete the construction by December 31, 1945.

The service proposed to be rendered by the project, initially and for the first 5 years, will consist of supplying (a) to Ohio Fuel Gas Co., 125,000,000 cu. ft. of natural gas a day at a point near Toledo, and (b) to Michigan Consolidated Gas Co. all of its natural-gas requirements above the amount to be furnished by Panhandle Eastern Pipe Line Co. under existing contracts. It is expected, the application says, that the rate to be charged by the applicant for the natural gas which it will deliver to Ohio Fuel and Michigan Consolidated, based on present costs, will be 22½ cents per 1,000 cu. ft.

"During the war period," the application continues, "the pipe line, as designed in this application, will be able to deliver to Ohio approximately 295,000,000 cu. ft. per day for short periods. This can be accomplished by the use of the Austin storage field, which, with the 5,000-hp. power compressing station contemplated in the plan, will be able to deliver 200,000,000 cu. ft. per day into the 26-in. line to Detroit, of which some 150,000,000 cu. ft. will be available for Ohio, through the 22-in. connecting line.

American Light & Traction, a holding company, controls Michigan Consolidated Gas Co. of Detroit. The applicant proposes to organize a wholly owned corporate subsidiary under the laws of Delaware, with the name of Michigan-Wisconsin Natural Gas Pipe Line Co., to construct, own and operate the pipe line for which a certificate is requested.

Pew Warns Against Cartel Trend

PHILADELPHIA. — Cartelization of world trade under so-called international "trade accords" is the greatest danger now threatening economic progress in America, J. Howard Pew, president of Sun Oil Co., warned this week.

"This means, of course, cartelizing American domestic activities as well as international trade, for the two cannot be separated into isolated compartments," Pew said. "Moreover, the only difference between cartels among private enterprises and cartels controlled by Government is that the latter are more reprehensible."

Pew cited the Anglo-American petroleum agreement, proposed last summer, as an example of the type of trade accord which would destroy free enterprise.

"The same stifling of competitive and economic opportunity that was present in the old NRA codes now reappeared in the guise of an international trade accord—a superstate cartel—an international monopoly under the control of governments," he said.

Pew's statement was included in a message to stockholders, accompanying the company's annual report for 1944.

Pointing out that the year's operations have again demonstrated that there is "no profit in war for industry," Pew reported a net income for Sun Oil Co. and subsidiaries in 1944 of $13,350,217, equivalent to $4.15 per share on 3,119,582 full shares of common stock, compared with $13,353,524, or $4.56 per share, in 1943. The return on operating income was 2.2 per cent, which, except for 1921, is the lowest percentage of profit on volume of business done in the history of the company.

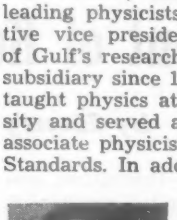
Sun Shipbuilding & Drydock Co., wholly owned Sun Oil subsidiary and operator of the largest commercial shipyard in the world, had a return of 1.2 per cent of volume of business. Sun Ship's gross business for 1944 was $275,549,666, and net income after taxes was $3,301,568.

Pew stressed his belief that "there are in this country vast oil lands awaiting discovery and development and that there is no immediate need to turn to foreign countries." Sun Oil's policy, he said, has been to concentrate its search for oil in the United States, with the exception of limited holdings in Venezuela and concessions in the Province of Alberta and in the Maritime Provinces of Canada, none of which acreage is proven.

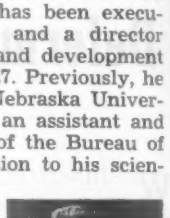
Foote and Heald Promoted by Gulf

PITTSBURGH.—Kenneth C. Heald, chief geologist, and Dr. Paul D. Foote, executive vice president of a subsidiary, Gulf Research & Development Corp., last week were elected vice presidents of the parent company, Gulf Oil Corp.

Dr. Foote, one of the nation's leading physicists, has been executive vice president and a director of Gulf's research and development subsidiary since 1927. Previously, he taught physics at Nebraska University and served as an assistant and associate physicist of the Bureau of Standards. In addition to his scientific accomplishments, Dr. Foote has achieved eminence as an editor of scientific publications. Until 1932 he served as editor of the Scientific Instrument Review, associate editor of the Franklin Institute Journal and editor of the Optical Society Journal.



K. C. HEALD



P. D. FOOTE

Dr. Foote is a graduate of Western Reserve University. He received his master's degree at Nebraska University and his Ph.D. at Minnesota University.

Heald began his geological career in 1908 after receiving his education in geology and mining at University of New Mexico, Colorado College and Yale University. He was appointed to the United States Geological Survey in 1914 and 5 years later became chief of the oil and gas section. In 1924 he became professor of petroleum geology at Sheffield Scientific School, Yale, and in 1925 was made staff geologist of Gulf Oil Corp.

He was member-at-large of the National Research Council in 1925-26 and in 1927 represented the Geological Society of America on the council. During World War 1, Heald was captain in the Army Engineers.

THIS WEEK

REFINING— Construction of five new aviation-gasoline plants scheduled—Cost: $78,000,000. . . . Other similar facilities under consideration. . . . ¶Prospective early diversion of 100-octane components to synthetic-rubber production elevates new refining facilities to urgency status. . . . ¶PAW striving for operating cushion to maintain supply above military consumption levels. . . . ¶Industry and officials warned that thermal cracking facilities have been overtaxed, will need replacement on more liberal basis. . . . ¶Record, uninterrupted air pounding of Germany and Japan shows war advantages of record production, indicates more devastating program ahead. . . .

TRANSPORTATION— Tank-car deliveries to East Coast improving but are still short of schedule. . . . Daily receipts at mid-February averaged 487,826 bbl., up 62,671 bbl. from the previous week. . . . February program called for overland movement of 535,000 bbl. daily. . . . There are still some snarls but they are being untangled. . . . ¶WEP 20-in. products line sets new throughput record, operating exclusively on gasoline. . . .

MATERIALS—Industry allocated 511,500 tons of steel for second quarter. . . . Quota about 10 per cent below scheduled requirements, placing burden of fulfillment on inventory. . . . ¶New steel supply will accommodate about 6,290 wells, leaving 610 of program dependent on tubular inventories. . . . ¶Industry's quota definitely better than mid-December outlook. . . . ¶WPB assigns committee of top industrialists task of getting utmost from available steel supply, to see if new productive capacity is needed.

PRICES— I.P.A.A. sends questionnaire to poll membership on permanent price differential for stripper wells. . . . ¶OPA certifies additional list of pools for subsidy payments. . . . ¶D. T. Andrus, Penn Grade Crude Oil Association president, asserts subsidy has "kept enormous number of wells producing." . . . Contemporary producer, Walter S. Hallanan, Pittsburgh, previously branded subsidy "a complete and costly failure," citing decline in Pennsylvania output. . . .

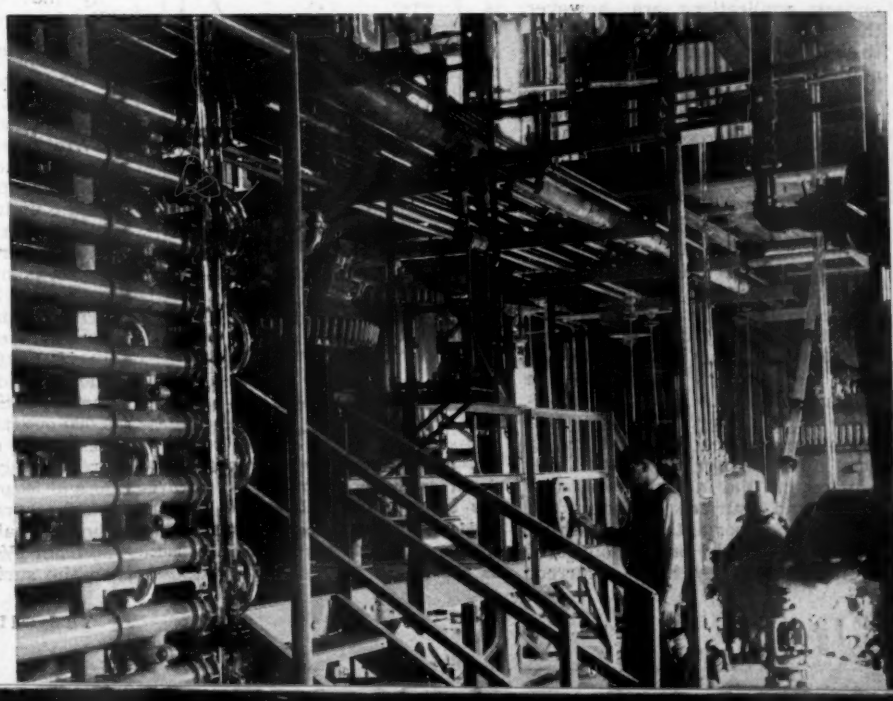
INTERNATIONAL— Informal discussion of Anglo-American oil agreement scheduled between Justice and State departments, PAW and PIWC. . . . Last week's session with Senate foreign relations committee left unsolved the antitrust guarantee. . . . ¶J. Howard Pew, Sun Oil Co. president, renews attack on "cartel" agreements, compares original Anglo-American pact to NRA. . . . ¶Rumors persist that Canol project in Canada's Northwest Territory will be abandoned. . . . Canadian Government reported uninterested in exercising option to purchase facilities. . . .

SYNTHETIC RUBBER— U. S. consumption of synthetic rubber in 1944 was 565,000 tons, constituting 85 per cent of total. . . . Manufacturing rate expected to rise to 1,000,000 tons annually before this year ends. . . .

MANPOWER—PAW issuing new procedure for seeking deferment of key personnel. . . . Additional losses of essential men appear inevitable, possibly up to 60 per cent of those between 18 and 30. . . .

DRILLING— Completion rate approximately unchanged at 460 weekly. . . . ¶New depth record for Texas established in Brazos County where well is drilling below 15,500 ft., may go to 17,000 ft. . . .

PRODUCTS— All grades of fuel oil scarce at eastern and northern consuming centers. . . . ¶Kerosene particularly scarce, output cannot be raised without cutting into Navy special diesel. . . . ¶Mass production of jet engines may pose new aviation-fuel problem. . . .



Glass lined vessels and Pyrex piping at all points where it is desired to prevent contamination of the latex and chemicals is one of the distinctive features of this new rubber polymerization pilot plant at Phillips Petroleum Co.'s laboratory at Phillips, Tex. J. E. Troyan, formerly attached to the process development section, Office of Rubber Director, is supervising a staff of chemists and chemical engineers in experimental studies related to the production of better quality polymers. The pilot plant contains diversified equipment for distillation and purification of monomers, polymerizers, coagulation unit and filtration and drying equipment. Capacity is sufficient for full-scale rubber processing and tire tests

West Edmond Conditions Show Possibilities of Increasing Recovery by Pressure Maintenance

by Kenneth B. Barnes

A FEATURE of prime importance in today's production practice is the use of pressure maintenance to obtain additional oil and to maintain potential capacity to produce established reserves. The West Edmond pool currently is a prime prospect for this type of operation. Operators there have been analyzing specific factors involved in such a program.

First, current average cost of finding, developing, and producing new reserves in the United States is of the same order, or greater, than the selling price of crude oil. An average, of course, is derived from both low and high figures, and there is no exception in the cost of establishing and producing new reserves. Each producer has his own position in this average, but the difficulty of continuing to produce "new oil" on anything approaching a reasonable, economic basis nevertheless is well known to all. It is the number one problem in the industry. A barrel of extra oil at 40 cents production cost obviously is more profitable than that which can be discovered only at the culmination of a string of dry holes at $1, $1.50 or more per barrel. As one result, secondary-recovery efforts are now at an all-time high.

Commendable and worthy as secondary applications are, however, they are aptly named. By definition, they cover injection processes to formations where the primary recovery forces have been depleted. They are used in fields from 5 to 75 years old. Secondary recovery has been classified as an "attempt to cure past mistakes."

Differences in Methods

There is good reason for petroleum engineers stating that secondary efforts are an attempt to get maximum recovery. The distinction is in the inherent difference in recovery which can be obtained in most instances by employing the proper practices at the start, particularly injection processes (or pressure maintenance) as against using them later. Shrinkage of the oil still in place and the increase of its viscosity and surface tension are changes in important factors which cannot be quickly or economically reversed once they have occurred. Practically, any substantial reversion of these changes may be impossible.

The large quantity of gas needed to be retained in the reservoir crude oil and in the structure under pressure maintenance, can only be held there by starting gas or water injection at an early date. At West Edmond, total gas in place amounts to about 800 billion cubic feet. The more the delay, the more the gas is depleted and the less effectively can gas thereafter function, if reintroduced, in accomplishing increased recovery and maintaining productive capacity.

West Edmond Conditions

West Edmond conditions illustrate the economic and conservation situations expressed above. Many of the operators there are well aware of the large possibilities of increasing recovery by pressure maintenance and the "extra oil" involved. There is belief that most of the additional oil would be lost if gas return is long delayed such as to the point where "tail-end" gas driving practices are finally used. A consulting engineering firm has been employed by several of the operators to render a report of the feasibility of a gas-injection pressure-maintenance operation, and large benefits from such work have been predicted.

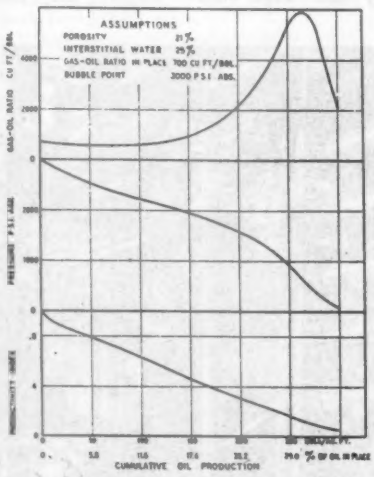


Fig. 1: Calculated trends for a pool produced solely by expansion of dissolved gas as shown by Babson. The acre-foot yields for 10.5 per cent porosity, correspondingly, would be only half as much as shown

A committee of the West Edmond Engineering Association is currently engaged in a study of gas-injection pressure-maintenance operation.

Production by Dissolved Gas-Drive

West Edmond conditions are illustrative of the importance of pressure maintenance on two counts: (1) The magnitude of the single pool itself, and (2) the high pressure, dissolved gas-drive conditions at a depth of 6,800 ft. As the pool continues to expand, there is prospect of at least 30,000 productive acres. West Edmond is the only pool in Oklahoma with remaining resources in the 200-million-barrel classification, and it is one of about 20 such major pools in the country.

If production history to date suggests that West Edmond may be better than the average Hunton limestone pool heretofore produced in Oklahoma, it nevertheless begins to show the characteristic rapid decline in reservoir pressure, rapid increase in producing gas-oil ratio and consequent rapid decline in productivity that has always characterized Hunton production.

Reservoir Conditions

As to the second count, reservoir conditions, status is as follows: Initial reservoir pressure in the Bois d'Arc was 3,110 p.s.i. On November 15, the average reservoir pressure, in spite of additional drilling in the undrained high-pressure area, had fallen to an average of 2,779 p.s.i., when the accumulated recovery was only 6,105,000 bbl. of an estimated 800,000,000 bbl. in place. (The estimated recovery by straight depletion operation is approximately 200,000,000 bbl.) In all respects the crude oil in the reservoir is normal. Solution gas is approximately 1,000 cu. ft. per barrel on stock-tank basis. The crude oil produced is approximately 40° A.P.I. in gravity. A loss of 50 per cent in stock-tank volume occurs in the shrinkage from the original reservoir condition, that is, from 1½ volumes in place to one on the surface.

Producing Gas-Oil Ratios

The average producing gas-oil ratio (October 1 to November 1, 1944) was reported to be 1,007 cu. ft. per barrel with only six wells penalized by the Oklahoma Corporation Commission's order of September 1944, which fixed permissible maximum ratio of 2,000 to 1. The ratios, however, are tending to increase in a manner characteristic of Hunton production and the rate of increase may be even greater than usual because the West Edmond Hunton limestone is a reservoir that will tend to produce a free gas cap as a consequence of large structural closure. The number of wells producing gas in excessive ratio is steadily increasing. Evidence of this situation is noted in a recent application to the commission requesting an exception on a number of wells to the existing gas-oil ratio rule.

Calculations of Reservoir Behavior

Consideration of pressure maintenance for a pool like West Edmond, once the reservoir factors and producing conditions are ascertained by drilling and early withdrawals, in one part quickly resolves to a series of engineering and economic determinations. These include: (1) probable performance under the inherent dissolved gas expansion mechanism; (2) the behavior which may be expected under various degrees of pressure maintenance; (3) the investment and operating costs for the gas return program; (4) changes in future flowing life and productivity; (5) and a number of different economic summaries of these factors.

On the performance of a producing reservoir by gas expansion or pressure depletion, an excellent type illustration or sample calculation has been given by E. C. Babson[1]. These calculations by no means are simple, and a large number of computations are necessary.

The illustrative calculations of Babson are of particular interest here because the data which were used, with the exception of porosity (21 per cent), were in rather close correlation with the reservoir factors which prevail in the West Edmond pool. At West Edmond the average porosity of the Bois d'Arc pay section is only about one-half of the porosity factor. With recognition, however, to this item and the fact that the calculated yields therefore would be only about one-half as much, the graphs are believed to represent, to some extent, the future trends for the West Edmond reservoir which would prevail under ordinary depletion to atmospheric pressure. As pointed out by Babson and van Wingen, the calculations were limited, quantitatively, to ideal conditions and certain laboratory experiments pertaining to gas-oil ratio behavior as a function of saturation. Actual production experience in a number of pools, some of them productive from limestones, and also other laboratory work on actual cores (including limestones) show the relative permeability and gas-oil ratio to rise sooner and continue much higher than covered by the curve in Fig. 1.

In brief, the following steps were used in Babson's procedure: Small increments of oil and gas were assumed to be withdrawn from the reservoir, with the resultant equilibrium pressure calculated by the material-balance method. Having the remaining reservoir pressure and amount of oil left, the corresponding oil saturation was calculated, and the gas-to-oil permeability ratio, K_g/K_o, obtained from the data of Leverett and Lewis. The permeability ratio was converted to free gas-oil ratio by correcting for the viscosities and densities of the gas and oil phases. The free gas-oil ratio found in this manner, plus the gas in solution in the oil at reservoir conditions, equals, of course, the total gas-oil ratio. When the calculated gas-oil ratio did not agree with the assumed ratio, the calculations were repeated using a different assumed ratio.

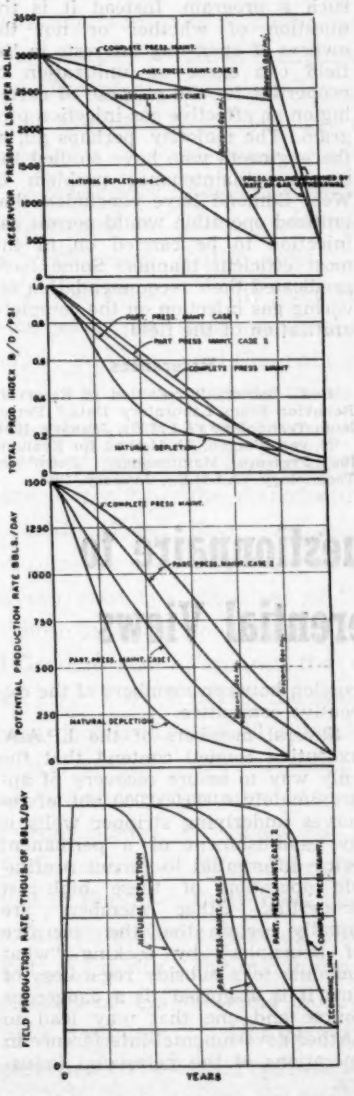


Fig. 2: Trends for the same pool as shown in Fig. 1 for natural depletion and three cases of pressure maintenance as shown by Van Wingen

When an agreement was found for the gas-oil ratios, additional increments of oil and gas were again assumed to be withdrawn and the same kind of calculations repeated. Further step-by-step computations were made until the reservoir reached atmospheric pressure. The graphs showing the derived gas-oil ratio, reservoir pressure, and productivity index during total producing life are all given in Fig. 1. From the practical standpoint, important features of the results are the continuing decrease in productivity index and the low recovery of total oil in place.

When the oil recovery had reached 34 per cent it was found that the pressure was 145 p.s.i., however, the productivity had dropped to 6 per cent of the initial value and the maximum productive capacity to about 8 bbl. per day per well. It was pointed out that the latter probably is about the economic limit for most deep wells.

Babson investigated the effects of full pressure maintenance, and found total oil recovery of approximately 51 per cent when an eventual complete sweep of the gas front was had by all the wells.

In another recent article, N. van Wingen[2] used the same basic reservoir data as Babson in evaluating performance under pressure maintenance for three different degrees of gas return. For the first case, total gas returned was taken as 33.3 per cent of the total gas reserve by natural depletion. For the second case, 70.3 per cent was used. For the third, or complete pressure maintenance, it was found that 130.8 per cent return of the total gas reserve by natural depletion would have to be made, which means "make-up" or outside gas was required. Results of the calculations in graphical form are shown in Fig. 2. These depict the future behavior of reservoir pressure, total productivity index, potential production rate per well, and field production rate under natural depletion and for the three cases of pressure maintenance. The time scale in years given on the curves in the original reference has been removed because the number of acres and producing rate in the type calculations were considerably different from those factors at West Edmond.

The summary of van Wingen's recovery calculations were:

Method of Production—	Recovery of Tank Oil in Place
Partial pressure maintenance, Case 1	37.7%
Partial pressure maintenance, Case 2	44.7%
Complete pressure maintenance, Case 3	52.5%

The comparable recovery for normal depletion of the reservoir was only 25.6 per cent of the tank oil in place.

Factors Appear Favorable

While there may be some concern expressed over the success of a gas injection operation into a limestone reservoir, the pertinent factors which must be considered appear favorable to many of the engineers at West Edmond. The reservoir has a closure to the oil-water contact of some 400 to 500 ft. This accrues to the advantage of gas injection since gas returned into the structurally high parts would be effective in pushing the oil down structure to producing wells. Most reservoirs, and nearly all limestone reservoirs that have heretofore had gas injected, did not have this advantageous feature so pronounced. The other factor that concerns many is the question of the amount of increase in ultimate recovery that will be obtained by gas injection. Many debate whether the increase would be 20 per cent or 50 per cent. One series of illustrative calculations already have been presented here. The exact figures may not be all-important in view of the fact calculations of some which have shown that even the minimum estimation of an increase of 20 per cent would cause a gas injection operation to be highly profitable to everyone concerned.

There have been some expressions that the Bois d'Arc section will have the benefit of a natural water drive which to a degree will maintain pressure and increase ultimate recovery. Evidence of such a situation, however, even at the present time, is reported to be unconvincing at best. The degree of water encroachment that may be expected from performances to date, appears too small and, at most, it can be regarded only as a means of augmenting pressure maintenance by gas injection.

The greatest difficulty that usually is faced in considering gas injection operations as, for example, in the West Edmond pool, is not a justification of the feasibility of such a program. Instead it is the question of whether or not the owners of operating interests in the field can agree on unitization of properties for the purpose of carrying on an effective gas-injection program. The majority, perhaps all, of the engineers who have studied the pressure maintenance problem in West Edmond have concluded that unitized operation would permit gas injection to be carried on in the most efficient manner. Some have predicated their recommendation favoring gas injection on the complete unitization of the field.

References

[1]E. C. Babson, "Prediction of Reservoir Behavior From Laboratory Data," Petroleum Technology (A.I.M.E.), January, 1944.
[2]N. van Wingen, "A Method for Evaluating Pressure Maintenance," Petroleum Technology, (A.I.M.E.), January, 1944.

I.P.A.A. Mails Questionnaire to Test Price-Differential Views

POLL of the Independent Petroleum Association of America membership on the issue of a permanent price differential for stripper crude-oil production was under way this week. Accompanying questionnaires to the I.P.A.A. membership was a covering letter emphasizing that replies do not constitute a binding vote for the reason that the by-laws make no provision for resolving association questions by mail ballot.

C. E. Buchner, executive manager, explained that the poll by questionnaires will be "helpful in guiding the executive committee and officials for whatever action is proper."

Decision to poll the I.P.A.A. membership on the permanent price differential was reached at Oklahoma City January 30 after a heated discussion between members of the executive committee.

Several members of the I.P.A.A. executive council contend that the only way to assure recovery of approximately 4,000,000,000 bbl. of reserves underlying stripper wells is by establishment of a permanent price differential to permit profitable operation of these high-cost properties. Other members are equally certain that the "sacrifice of principles" by seeking "what amounts to a subsidy regardless of how it is disguised" is a dangerous course and one that may lead to further governmental interference in operations of the petroleum industry.

"Your full thinking on the effect of this program whether you approve or disapprove, is invited," Buchner wrote in his covering letter. "Your comments on either phase will help to guide us. We hope you will elaborate fully and freely on each section of the questionnaire including your answer to the third question where you may set forth your ideas of any method you may have to provide funds for such programs."

Questions Asked

Questions in the mail-poll form are:

1. Do you favor a permanent differential in the price of crude oil produced from stripper wells and also by secondary-recovery operations?

2. If your answer to No. 1 is "yes", do you believe that such differential above the posted price should be paid by the federal Government out of funds raised by general taxation?

3. I recommend the following plan to furnish the funds for this purpose . . . . . .

Pact's Antitrust Aspects Still Under Discussion

WASHINGTON.—A new draft of the Anglo-American petroleum agreement was discussed informally at a meeting February 22 of the Senate committee on foreign relations with officials of the State Department, Petroleum Administration for War, and the national oil policy committee of the Petroleum Industry War Council.

The committee will hold another meeting next week with officials of the Department of Justice, particularly regarding the demands of the oil industry that a provision be included guaranteeing that actions taken by the industry to follow recommendations of the International Petroleum Commission would not be subject to prosecution under the antitrust laws.

This antitrust angle apparently is the only point in the draft on which there is not yet complete agreement. Officials of PAW and the State Department are understood to be in sympathy with the industry position, but as yet no suitable language has been worked out to provide for clearance with the Department of Justice.

The conference was reported to be quite harmonious, with general agreement on all points of the new draft, which is understood to follow quite closely the version submitted to the State Department by PIWC. Chairman Tom Connally of Texas, who vigorously opposed the original treaty, said he thought the new version would receive general acceptance by the oil industry.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Supporting Air Offensives

THE announcement last week that four refining companies would spend 78 million dollars of their own money in new aviation-gasoline facilities is another demonstration of this industry's complete support of the war program. The additional plants are a further guarantee of adequate supplies in maintaining all-out offensives.

The enemy everywhere now knows what was meant when he was told that if he persisted in continuing as a belligerent the time would come when his every facility of war from the front lines to the distant factory would be the target of the many-headed and petroleum-powered aviation arm of Allied forces.

The thousands of planes which Goebbels and others termed a "dream" of our visionary propagandists have become the nightmare of reality, uprooting supposedly impregnable fortifications, destroying manufacturing plants and severing essential arteries of transportation. Every activity of the air has been coordinated with those of land, so that a disillusioned and confused German people are now faced with final disaster.

In the Pacific, where the Japanese homeland felt secure because of its remoteness, war-production facilities of every description are starting to crumble before large-scale attacks from planes, many of which, aided by new superfuels, are making round trips from their bases equal to the distance between the two Portlands in this country.

These air combat operations are part of rapidly expanding offensives. There are thousands of less publicized, but equally essential, war activities entirely dependent on air transportation. The paratroop and other air-borne operations have revolutionized certain phases of military strategy. When the war is over it will be revealed that military and governmental officials were able to make major decisions daily because air transportation brought them together for conferences from scattered points of the Allied world.

Every war movement has been expedited by air-transported equipment and supplies. Thousands of lives are being saved because the ambulance planes quickly remove the wounded from battle areas.

The hundreds of thousands of air-trained men and women of our Army, Navy and Marine Corps and those of our allies, who make these operations possible, are entitled to every honor that has been given them.

A summary of the facilities devoted directly to the manufacture of aviation gasolines could not have been visualized fully, in prewar days, even by those who have spent a lifetime in refining. A report as of the first of the month shows more than 60 catalytic cracking plants are operating "around the clock." Other operations include nearly the same number of alkylation installations and 38 isomerization units. Five thermal cracking or reforming plants have been built with the same number of hydrogenation operations.

Every one of these war installations has constituted a major construction activity. In addition there have been literally hundreds of changes in processing practices for the purpose of assuring the maximum output of 100-octane gasolines now totaling more than 500,000 bbl. daily.

In a very real sense the 150,000 men and women who operate the Allied refineries and transportation activities are part and parcel of today's air offensives.

A.P.I. Tally of Petroleum Reserves Shows 20,453,231,000 Bbl.; 2 Billion Gain

Proven reserves in the United States increased during 1944, reversing 1943's downward trend, despite record-breaking production withdrawals from the reservoirs and wartime restrictions on new drilling. These conclusions of the A.P.I. check exactly with those of The Oil and Gas Journal's annual analysis in the January 27 issue and the total proven reserves vary only 0.3 per cent.

NEW YORK.—More than 2 billion barrels of new petroleum reserves were added to the oil supply of the nation during 1944 by the discovery of new oil pools and the further development of older pools, according to the annual report of the American Petroleum Institute committee on reserves released here last week.

Despite record crude-oil production of 1,678,000,000 bbl. during the year, the net gain in the proved oil reserves of the country amounted to 389,000,000 bbl. in 1944. During the year Alabama became the twenty-sixth oil-producing state, while Louisiana and Mississippi led all other states in the reserves added by discovery. Texas, with reserves of 11,375,000,000 bbl., has 55.6 per cent of United States oil reserves, with California, Louisiana, Oklahoma, Kansas, Wyoming, and New Mexico following in the order named. In 1944 the new reserves resulting from the discovery amounted to 511,000,000 bbl., the highest figure since 1938, while additions to reserves by development added another 1,556,000,000 bbl. Crude-oil withdrawals from reserve amounted to 24.2 per cent more than those of prewar 1941.

The full report of the A.P.I. committee, J. Edgar Pew, chairman, follows:

"The committee estimates that the proved reserves of crude oil in the United States, as of December 31, 1944, amounted to 20,453,231,000 bbl. This is derived as follows:

Derivation—		Barrels
Total proved reserves as of December 31, 1943		20,064,152,000
Extensions (new oil) and revisions during 1944	1,556,192,000	
New reserves (new pools) discovered in 1944	511,308,000	2,067,500,000
Total proved reserves as of December 31, 1943, and new proved reserves added in 1944		22,131,652,000
Subtract production during 1944		1,678,421,000
Total proved reserves as of December 31, 1944		20,453,231,000
Increase in reserves since December 31, 1943		389,079,000

"The estimates in this report, as in all previous annual reports of this committee, refer solely to proved or blocked-out reserves of crude oil (including condensate) known to be recoverable under existing economic and operating conditions. Therefore, they do not include:

"1. Oil under the unproved portions of partly developed fields.

"2. Oil in untested prospects.

"3. Oil that may be present in unknown prospects in regions believed to be generally favorable.

"4. Casinghead gasoline extracted at natural-gasoline plants in moderately low-pressure fields.

"5. Oil that may become available by secondary-recovery methods from fields where such methods have not yet been applied.

"6. Oil that may become available through chemical processing of natural gas.

"7. Oil that can be made from oil shale, coal, or other substitutes.

"Proved reserves are both drilled and undrilled. The proved drilled reserves, in any pool, include the oil estimated to be recoverable by the production systems now in operation (whether primary or secondary) and from the area actually drilled up on the spacing pattern in vogue in that pool. The proved undrilled reserves, in any pool, include reserves under undrilled spacing units which are so close, and so related, to the drilled units that there is every reasonable probability that they will produce when drilled.

"In the case of new discoveries, which are seldom fully developed in the first year and in fact for several years thereafter, the estimates of proved reserves necessarily represent but a part of the reserves which may ultimately be assigned to the new reservoirs discovered each year. For a one-well field where development has not yet spread beyond the discovery, the area assigned as proved is usually small in regions of complex geological conditions, but may be larger where the geology is relatively simple. In a sparsely drilled field the area between wells is only considered to be proved if the information regarding the geology of the field and the productive horizon is adequate to assure that such area will produce when drilled. The total of new oil through discoveries estimated as proved in any given year is comparatively small and the total of new oil through extensions is comparatively large. As knowledge of the factors affecting production and well performance become available, and as these factors are studied, reserves in older fields can be estimated with greater precision and revised accordingly. Therefore, the oil assigned to new discoveries (see Table 1, Column 3), plus the oil proved through extensions (see Table 1, Column 2), comprises the total quantity of the new proved reserves for the year.

"The committee again wishes especially to stress the fact that its estimates of proved reserves cannot be used as a measure of the rate at which these reserves can be produced with or without physical waste. Oil cannot be produced from the permeable rocks in which it occurs at any desired rate, because the flow of oil through the pores of the oil-bearing rocks is definitely controlled by physical factors of the reservoir. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates, as has been widely demonstrated by past performance under all kinds of operating conditions. For this reason, those, who, through arbitrary division of the known reserves by any current rate of production or by any anticipated rate of consumption, try to estimate the life of proved reserves of oil, or the rate at which these reserves can be produced, arrive at an incorrect conclusion.

"For comparative purposes a summary tabulation is appended (Table 2) of the over-all figures contained in the committee's annual reports covering the period from 1937 to 1944, inclusive. Figures for 1935 and 1936, which were the first developed by the committee, are not available separately.

"As in the past, this committee wishes to emphasize the fact that every effort has again been made

TABLE 1—ESTIMATED PROVED PETROLEUM RESERVES IN THE UNITED STATES
(Barrels of 42 U.S. gallons)

	Proved reserves as of Dec. 31, 1943 (1)	Changes in proved reserves due to extensions (new oil)* and revisions during 1944 (2)	Proved reserves in new pools discovered in 1944† (3)	Production during 1944 (estimated) (4)	Proved reserves as of Dec. 31, 1944 (Columns 1 + 2 + 3 less Column 4) (5)
Alabama	.....	.....	360,000	43,000	317,000
Arkansas	296,929,000	20,423,000	5,148,000	29,441,000	293,059,000
California	3,336,823,000	242,575,000	76,925,000	311,771,000	3,344,552,000
Colorado	45,111,000	46,025,000	647,000	2,960,000	88,823,000
Illinois	294,622,000	100,661,000	2,727,000	77,296,000	320,714,000
Indiana	31,039,000	3,887,000	1,657,000	5,090,000	31,493,000
Kansas	645,852,000	42,431,000	12,498,000	99,030,000	601,751,000
Kentucky	35,190,000	15,236,000	331,000	9,677,000	41,080,000
Louisiana	1,483,826,000	107,062,000	112,055,000	129,556,000	1,573,387,000
Michigan	55,248,000	17,745,000	10,700,000	18,559,000	65,134,000
Mississippi	38,872,000	6,973,000	179,533,000	16,367,000	209,011,000
Montana	106,057,000	11,829,000	346,000	8,582,000	111,650,000
Nebraska	1,000,000	.....	.....	419,000	581,000
New Mexico	653,981,000	—54,101,000	2,240,000	39,556,000	562,564,000
New York	90,525,000	.....	.....	4,694,000	85,831,000
Ohio	32,643,000	.....	1,925,000	2,944,000	31,624,000
Oklahoma	908,618,000	165,547,000	20,844,000	124,747,000	970,262,000
Pennsylvania	137,323,000	.....	.....	14,185,000	123,138,000
Texas	11,324,954,000	740,213,000	58,103,000	747,790,000	11,375,480,000
West Virginia	43,839,000	.....	.....	3,084,000	40,755,000
Wyoming	499,394,000	89,636,000	25,269,000	32,569,000	581,730,000
Miscellaneous‡	306,000	50,000	.....	61,000	295,000
Total United States	20,064,152,000	1,556,192,000	511,308,000	1,678,421,000	20,453,231,000

*Extensions greatly exceed revisions. †Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, for in this report we are concerned only with actually proved reserves. ‡Includes Florida, Missouri, Tennessee, Utah and Virginia.

TABLE 2—SUMMARY OF COMMITTEE'S ANNUAL REPORTS COVERING PERIOD 1937-1944
(Barrels of 42 U. S. gallons)

	New oil blocked out during year				
Year	Through revisions of previous estimates and extensions to known fields	Through new pools discovered during year	Total through new discoveries, extensions and revisions	Production during year	Estimated proved reserves as of end of year
1936	.....	.....	.....	.....	13,063,400,000
1937	2,792,790,000	928,742,000	3,721,532,000	1,277,664,000	15,507,268,000
1938	2,243,571,000	810,493,000	3,054,064,000	1,213,186,000	17,348,146,000
1939	2,058,455,000	340,667,000	2,399,122,000	1,264,256,000	18,483,012,000
1940	1,607,012,000	286,338,000	1,893,350,000	1,351,847,000	19,024,515,000
1941	1,538,989,000	429,974,000	1,968,963,000	1,404,182,000	19,589,296,000
1942	1,618,925,000	260,051,000	1,878,976,000	1,385,479,000	20,082,793,000
1943	1,202,368,000	282,418,000	1,484,786,000	1,503,427,000	20,064,152,000
1944	1,556,192,000	511,308,000	2,067,500,000	1,678,421,000	20,453,231,000

to secure a fair, unprejudiced, and representative opinion. Each member in his district appointed a number of subcommittees to gather and study the necessary data. All previously determined factors pertaining to the various pools were examined and adjusted in the light of new information. The subcommittees, which were largely responsible for the data, were comprised of specially trained geologists and petroleum engineers with long experience in this class of work. We wish to acknowledge the valuable assistance and information received from these men, and others, and to thank all for their cooperation."

In addition to Chairman Pew, the A.P.I. committee on reserves is composed of R. F. Baker, The Texas Co., New York; D. V. Carter, Magnolia Petroleum Co., Dallas; Frank R. Clark, The Ohio Oil Co., Tulsa; Alexander Deussen, consulting geologist, Houston; G. Clark Gester, Standard Oil Co. of California, San Francisco; F. H. Lahee, Sun Oil Co., Dallas; J. M. Sands, Phillips Petroleum Co., Bartlesville; Fred Van Covern, A.P.I., New York; Theron Wasson, Pure Oil Co., and Fred E. Wood, Standard Oil Co. (Indiana), Chicago.

DEATHS

Thomas A. O'Donnell, 73, leading figure in the early days of California's oil industry, died February 20 in Los Angeles.

Born in Erie County, Pennsylvania, O'Donnell went to California at the age of 18. Entering the oil industry as a lease hand, he became field superintendent for Charles A Canfield, E. L Doheny, and Max H. Whittier. With them he became known as one of the "Big Four." With Canfield and Doheny he drilled the first oil wells in Los Angeles and later developed the Coalinga district. The three organized American Petroleum Co. and American Oilfields Co., with O'Donnell as vice president and field manager of both. The companies were merged into California Petroleum Corp., later sold to The Texas Co. O'Donnell helped to organize American Petroleum Institute and Independent Oil Producers Agency, and served as president of the former body.

Harry D. Neuhardt, 52, formerly an oil operator in Fort Worth and Amarillo, died February 19 in Sistersville, W. Va.

Lynn B. Riddle, 55, independent oil producer of Tulsa, and president of Life Line Pipe Co., of Nowata, Okla., died February 22 in Tulsa, where he resided. Riddle was vice president of the old Shaffer Oil & Refining Co., in charge of the production and land departments. When Deep Rock Oil Corp. took over Shaffer in 1924 Riddle became an independent operator.

Pfc. Harry L. Bickell, 24, of Limestone, Pa., employed by South Penn Oil Co. at the time of his induction, was killed in action January 28 in Belgium.

H. H. Welsh, pioneer California oil operator and one of the organizers of Independent Oil Producers Agency, died February 18 in Fresno. He had been in semiretirement several years.

John A. Graham, 75, retired construction foreman for The Carter Oil Co., died February 25 in Tulsa.

Completion Practices in Heidelberg Field Are Undergoing State of Evolution

by Neil Williams

Many early completion difficulties experienced in Mississippi's most active field are being overcome as operators gain familiarity with geological and structural complexities, and as development continues. Effective techniques are being worked out, as described here.

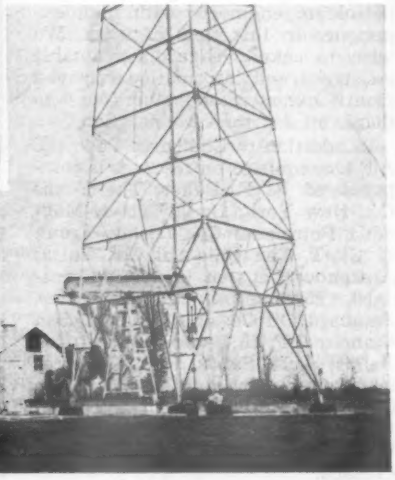
WELL-COMPLETION procedure in the Heidelberg field, Jasper County, Mississippi, has been greatly complicated due to an unusually complex structural and formational condition. As development continues and some of these complexities begin to unfold it is becoming possible to work out technique and a program of operation especially adaptable to the conditions. Many of the difficulties experienced in making wells during the early development of the field are now being overcome and some of the uncertainties eliminated. There still is much to be learned, however, and until all factors are understood, practices are expected to be in a state of evolution.

Heidelberg was a year old in February and now has more than 65 producing wells. Of these, more than 45 wells are in the original, or eastern side of the field, and about 20 on the west side, commonly designated as West Heidelberg. The east field extends some twelve to thirteen 40-acre locations from north to south at its present longest point and is from five to six locations wide at its widest point. West Heidelberg, about 2 miles distant, is from four to five locations long and three to four locations wide. Both are open to the north and south at places, and due to structural complexities may be subject to coming together around either or both ends.

With the exception of Tinsley, Yazoo County, Mississippi's first oil field, now virtually proved up and presumed to be well over its majority in production, no other field in the state has received as extensive development to date as Heidelberg. This no doubt is due to its diversified ownership, including many small companies and independents. Other fields opened so far are in the hands of not more than two or three operators, several by just one company, which has permitted more conservative, noncompetitive development programs.

Rapid Drilling a Factor

This rapid, competitive drilling of the field has been a factor in creating many puzzling questions as to the field's importance and may have delayed the adoption of the most appropriate completion and production practices. In the rush, many of the earlier wells, drilled by various operators, probably were brought in without due time to analyze properly the circumstances and without due consideration of the most effective technique. However, in the light of information revealed by these wells and with full appreciation of errors which might have been made in some cases, full advantage is now being taken of



Above: Heidelberg field takes in the townsite of the same name. This well is on the school ground where fencing is placed around the unit for protection

Above, right: Pumping unit at Heidelberg using gas-gasoline engine, unenclosed. At back of engine on stand is drum containing reserve supply of gasoline for fuel

Right: Pumping installation employing heavy-duty unit with 35-hp. gas engine enclosed. Production, making considerable b.s.&w., is pumped direct to heater-treater

this in present and prospective development.

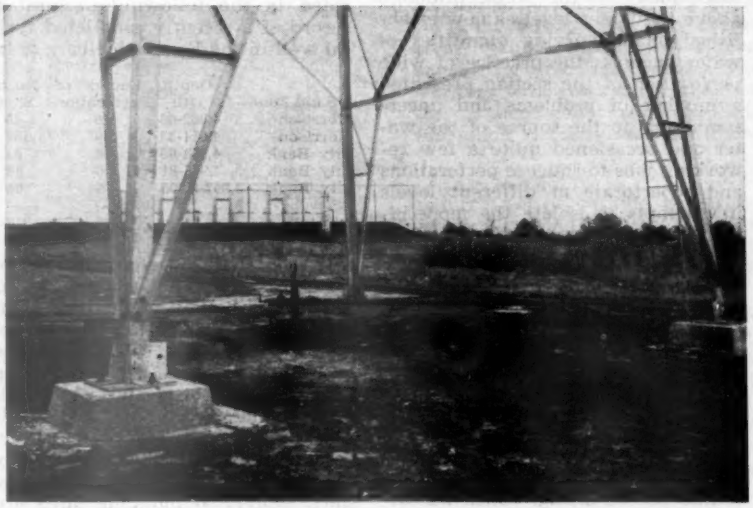
It already is indicated that some of the other new fields in the state may prove equally, if not more complex than Heidelberg. Only more extensive development, however, will bear this out. But with the experiences gained by operators in Heidelberg, and with a better idea as to what can be expected, operators may be better able to cope with the conditions from the start, and adjust their procedure to them more readily.

Structural Conditions

Heidelberg structurally is presumed to be a deeply seated salt dome of relatively large extent as is supposed to be true of most of the other new deep fields being opened in the south half of the state. At least it has the general characteristics of being one, and geophysical indications support the belief. It is featured by an extremely complicated fault pattern, including a series of major paralleling faults with irregular cross and radial faults, some having as much as 500 ft. of throw. Faults are marked by steep and step-down dips and fault blocks, one or more of which separate the east and west Heidelberg areas. These present many hazards in development. Sand zones and water levels are irregularly affected, which in turn has a direct bearing on well-completion and production procedure.

The productive horizon comprises a section 500 to 600 ft. thick taking in all the Eutaw formation and the upper part of the underlying Tuscaloosa. The main producing sands are in the Eutaw, which is topped at subsea depths of from around 4,000 ft. to 4,500 ft. in the east field and from 4,400 ft. to about 4,800 ft. in West Heidelberg. Surface elevations range from around 300 to 400 ft. Sands in the upper Tuscaloosa consist chiefly of stringers, and except in a few of the highest wells are below the water level.

Eutaw sands are grouped into four main zones of saturation. These are designated, in order, as the Morrison, City Bank, Stanley, and Christmas sands. The Morrison, or uppermost sand, usually comes in at or within a few feet of the top of the Eutaw. Tops of the others are picked up at intervals of approximately 130 ft., with the Christmas sand at the base of the Eutaw. Due to shaling, only in a few wells are all four sands found fully developed as solid sand bodies. Shaling varies considerably from well to well and thickness of the sand members varies accordingly. Frequently, these zones may be broken into stringers of varying thickness. Only in a few instances, however, have all the sand zones been completely shaled out. Generally, at least one, probably two, and occasionally three of the zones are fairly well developed.



One of the relatively few flowing wells in Heidelberg field. Flowing pressure is less than 100 lb. Separator and tank battery for lease appear in background

The most consistent sands have been the City Bank and Stanley zones. The Christmas sand also is largely developed, although much of this sand, the lowest, usually is below the water, except in the higher wells. In the lowest wells, around the outer edges, the Stanley sand and much of the City Bank sand also may be too low to produce. The Morrison sand on the whole is poorly developed, although in some wells it is possible to produce only from this zone.

Sand conditions in the east and west fields are comparable except for the slightly greater depths at which they are found on the west side. However, on the west side there are two different water levels, making three different water levels for the field and adding to the general complexity of conditions. Water-oil contact in the east field has been fairly well established at —4,674 ft., which as so far found is common to the entire section. In the West Heidelberg area the general water-oil contact has been —4,794 ft. Lately, however, one well found the water approximately 140 ft. below the latter depth. This well, located on the extreme east edge of the West Heidelberg area, had salt water in the three upper sands, but in drilling deeper cut a fault and found the Christmas sand saturated from which it has made one of the best wells of the field.

The discovery well, drilled by Gulf Refining Co. and located in the East Heidelberg area, was completed in only the Christmas sand with 33 ft. of saturation being taken in. The casing, which was run through the sand to bottom of the hole was perforated for this at 4,957-90 ft. (actual depth). This well flowed at the rate of 500 bbl. of clean oil daily through a 22/64-in. choke on the tubing with a pressure of 250 lb. Some of the other sands above this zone showed saturation but it was elected at that time to perforate only in the lowest important sand first, and then later to come up and recomplete in successively higher sands. However, in this well some of the section was faulted out, and it did not have the number of sands that since have been found in many of the other wells.

New Practice Indicated

With the completion of the second well, a diagonal northeast offset, the practice was initiated of taking in the entire section, perforating casing in all sands showing saturation. This included a total 15 sand levels with 12 in the Eutaw and 3 stringers in the upper part of the Tuscaloosa, comprising a section of more than 500 ft. topped at 4,414 ft. In it there was 200 ft. of net sand, and a total of 852 casing perforations was made. The relationship of the various sand groups in the Eutaw was not understood at that time, and the plan was to take in everything showing likely saturation. The well flowed at the rate of 1,000 bbl. of clean oil daily through a 22/64-in. choke.

Some of the subsequent early wells were perforated with as many as 1,000 to 1,200 shots. Often not only were just the strictly sand zones perforated but also some of the shaly sands and even shale.

Typical drilling well in field with plank roadway through stretch of low ground

Normally the shale would be too impervious to give up any oil, but occasionally it would show signs of some saturation at places and to avoid the chance of passing up anything some shale zones also would be taken in. The practice was to core and drill through the section, set and cement casing on bottom, and then with the aid of electric log determinations of zones of porosity and saturation, supported by core records, perforate everything which gave any indications of possible production.

A number of factors guided operators in this practice. First, the limited development at that time made it impossible to understand the reservoir conditions and sand relationships. Also, certain peculiarities and irregularities in the reaction of formations in electric logging were revealed and created a number of uncertainties in interpretation of logs and determination of the most effective zones of saturation. These peculiarities and irregularities have been manifest in other south Mississippi exploration and development, and attempts to complete wells. They have to do with the fact that in many cases, although not always, the resistivity curve in logs will turn inward through saturated sands, or just the opposite from what it should. Often saturated sands will indicate no more or even less resistivity than adjacent shales. Since this behavior was not uniform, doubts frequently arose as to these saturated sands, and when cores were not available for checking it was considered advisable to take in not only indicated but also all doubtful zones of saturation. This was especially desirable since many of the wells had relatively small productivity and needed all potential sand which they could possibly take in.

Oil production from all the zones had the same characteristics, and more recently it has been definitely established that the sands represent a common reservoir. Consequently, from this standpoint, no segregation of production from the various sands was necessary. However, since many of the wells, although above the water level as now established, made varying quantities of water and b.s., the practice of wide perforation of the section presented a number of problems and uncertainties as to the source of the water and occasioned quite a few reworking jobs to squeeze perforations and reperforate at different levels in attempts to isolate the more effective zones of production.

Water of Connate Origin

It now is considered probable that much of this water has been of connate origin, since the sands in this field, and also in Mississippi generally, have a relatively high connate content. It also is probable that some of the early difficulties may have been mechanical, possibly due in some cases to inadequate cement behind the oil string, which has allowed the water to come in from above or below the section. More recently, operators generally have undertaken to use more cement and exercise more care in preparation of the walls of the hole for cementing and in placing of cement. Several operators now follow the practice of cementing up behind the pipe to the top of the Selma chalk section around 3,750 to 3,800 ft. Also wall scrapers are being run in some wells to clean the walls and insure more effective cementing. Usually from 500 to 800 sacks of cement are pumped.

Also, in more recent completions the amount of casing perforation has been greatly reduced. Although in some instances this may be due to the fact that many of the wells have been at down-structure locations where there is less sand above the water to take in, general practice has become to limit perforations to the most effective levels of sand saturation. All effective sand zones in the section above the water still are taken in, but with the increased knowledge of sand and other conditions, and greater proficiency in identifying the most effective sand levels, it has been possible to confine perforations more accurately to them.

Extensive coring still is resorted to in many instances to check against electric logs. Also, general use is made of side-wall cores through the section to supplement the other means of determining points of most effective saturation. In some wells, gamma-ray surveys have been made after running casing to provide an extra check, and liberal use has been made of drill-stem testing individual zones separately to determine the productive potentialities of each.

Perforation Practice

The closeness with which perforations are now being made is indicated in the following perforation record of a recently completed typical well in the East Heidelberg area:

Sand Zone—	Depth (ft.)	Footage of Perforations	No. of Shots
Morrison ..	4,862-68	6	48
Morrison ..	4,914-33	19	152
City Bank..	4,958-66	8	64
City Bank..	4,975-81	6	48
City Bank..	4,992-5,000	8	64
Total		47	376

In completing wells after perforating casing, tubing, usually 2½-in., is set near bottom or at some point normally below the top of the producing zones. The setting is made with a production packer. Tubing then is swabbed and the well brought in by this method. Although some wells flow naturally, pressures are low, and the majority of wells must be pumped from the start. Individual pumping units are installed. These are powered by gas-gasoline engines of from 15 to 35 hp. each.

The oil is a heavy, asphaltic-type crude running in gravity from about 22° to 24°, although one well lately has been completed making a 30° gravity oil. Some of the oil is below 20° gravity. It is undersaturated and barely enough gas is recovered to operate the pumping engines and provide fuel for the treaters. Pumping engines are provided with a small tank of gasoline for auxiliary fuel for use when starting up or when the gas for other reasons is inadequate. Many of the wells make some b.s. and/or water. For treating, combination heater-treater units generally are used on each lease.

Present daily production is approximately 9,500 bbl., averaging less than 150 bbl. per well. Accumulated production is approximately 1,900,000 bbl.

Viscosity of Reservoir Liquids and Gases

Mechanics of Producing Oil, Condensate, and Natural Gas

*by Park J. Jones**

PART 18 OF A SERIES

The viscosity of reservoir gases may be estimated in terms of molecular weight, reservoir temperature, and pressure. However, for reservoir gases near their two-phase regions, there is need of more information.

There seem to be no general rules for estimating the viscosity of reservoir liquids. One method for estimating viscosity is based on the viscosity of oil at standard conditions, reservoir temperature, and saturation pressure. This method is not universal because it can be 100 per cent wrong. But the method gives results which are accurate enough for practical purposes when working with reservoir liquids similar to some other reservoir liquid for which viscosity data are known.

THE viscosity of a gas at atmospheric pressures for several temperatures is shown in Fig. 18-1. Viscosity in centipoises is plotted against the molecular weight of a gas. The molecular weight of a gas is equal to approximately 29 times its gravity relative to air.

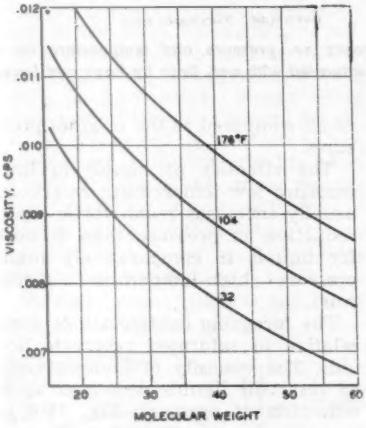


Fig. 18-1—Viscosity of gas vs. molecular weight and temperature at 14.7 p.s.i.a.

The viscosity of reservoir gases may be estimated from Figs. 18-2, 3, and 4. Fig. 18-2 shows gas viscosity vs. molecular weight for several pressures at 100° F. At this temperature, gases other than dry natural gas or residue gas from a plant may condense a liquid phase if compressed. The viscosity in the two-phase region is not generally known.

Fig. 18-3 shows viscosity for several pressures at 200° F. At this temperature, the two-phase region for reservoir gases is much smaller than at 100° F. The corresponding viscosity data at 300° F. are shown in Fig. 18-4. The probability of finding a two-phase region at this temperature is negligible within the limits of the conditions found in practice.

Interpolation for temperatures other than those given in the foregoing figures may be illustrated by the following example: Given the molecular weight of a reservoir gas, 30; reservoir pressure, 4,000 p.s.i.a.; and reservoir temperature, 150° F.

$$\text{Estimated viscosity} = 0.054 - (150 - 100)\,(0.054 - 0.037)/(200 - 100)$$

or 0.046 centipoises, where 0.054 and 0.037 are viscosities at 100° F. and 200° F. respectively.

Viscosity of Gas-Free Liquids

The viscosity of gas-free liquids at standard conditions varies from a fraction of a centipoise for some plant products up to several hundred centipoises for some oil. For example, the viscosity of natural gasoline at 60° F. is on the order of 0.3 centipoises; gasoline, about 0.6 centipoises; kerosene, about 2 centipoises; distillate, about 5 centipoises; and so on for the heavier cuts from an oil.

Viscosity determinations of gas-free liquids are based on the measurement of the time required for a

*Production consultant, Houston.

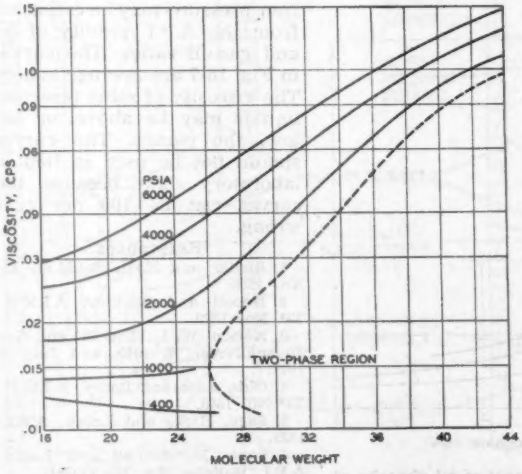


Fig. 18-2—Viscosity of gas vs. molecular weight and pressure at 100°F. Data by Bicher and Katz

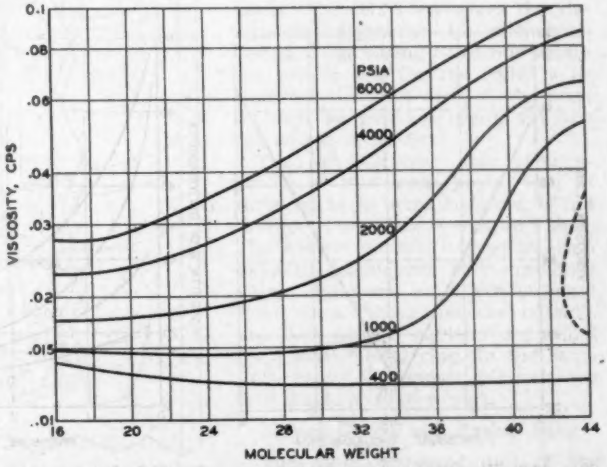


Fig. 18-3—Viscosity of gas vs. molecular weight and pressure at 200°F.; two-phase region within dashed curve. Data by Bicher and Katz

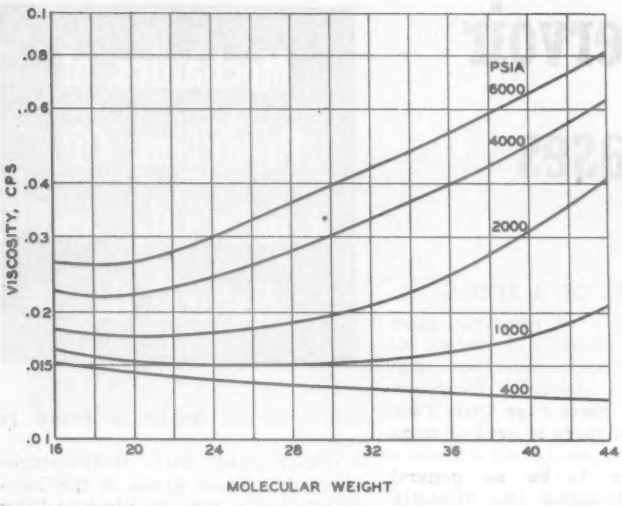


Fig. 18-4—Viscosity of gas vs. molecular weight and pressure at 300°F. Data by Bicher and Katz

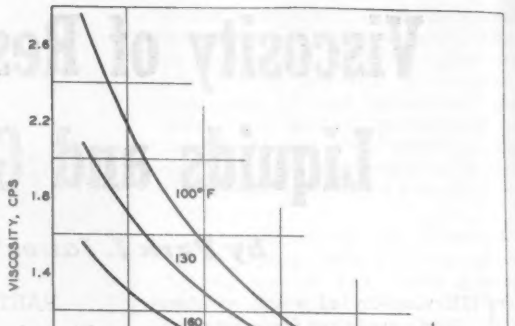


Fig. 18-5—Viscosity vs. pressure and temperature for a 33.9° A.P.I. oil saturated with gas. Data by Sage and Lacey

given volume of liquid to flow through an orifice. The instrument commonly used in this country is the Saybolt Universal viscosimeter. The following equations are used for this instrument:

1. For oil of 100 Saybolt seconds or less

$$\mu = (0.226t - 195/t)S \quad (1)$$

2. For oil above 100 Saybolt seconds

$$\mu = (0.220t - 135/t)S \quad (2)$$

where

μ = viscosity in centipoises at temperature for which
t = time of efflux, seconds
S = specific gravity at the temperature for which t is known

Viscosity divided by specific gravity is called kinematic viscosity. Kinematic viscosity is expressed in centistokes.

Viscosity of Reservoir Liquids

When an oil is heated its viscosity is reduced. The decrease in viscosity per unit increase in temperature varies with composition. If in addition gas under pressure is forced into an oil, the viscosity of the resulting composite is reduced still further. Fig. 18-5 is an illustrative example. The difference in the slopes of the curves in this figure is of interest in production.

The curve for 100° F. shows a twofold increase in viscosity corresponding to a pressure decline from 3,000 p.s.i.a. down to about 1,200 p.s.i.a. At pressures less than 1,200, the increase in viscosity with pressure decline is much steeper than at pressures greater than 1,200 p.s.i.a.

The curve for 220° F. shows a twofold increase in viscosity corresponding to a pressure decline from 3,000 p.s.i.a. down to about 300 p.s.i.a. Significant increases in the viscosity of many reservoir liquids do not occur until pressures decline down to values which are small compared to the original pressures.

The viscosity of liquids in low-pressure low-temperature reservoirs usually increases much faster upon reduction in pressure than it does for liquids in comparatively high-pressure high-temperature reservoirs.

The foregoing considerations were relative to saturated reservoir liquids. The viscosity of undersaturated reservoir liquids decreases upon reduction of pressure. Fig. 18-6 is an example.

Estimating Viscosity

If laboratory data on viscosity are not available, the viscosity of reservoir liquids may be estimated with the aid of curves similar to those in Fig. 18-7. Application of these curves is based on the viscosity of oil, reservoir temperature, and saturation pressure. The first two are usually known. The saturation pressure may be estimated from the A.P.I. gravity of oil and gas-oil ratios. The curves in Fig. 18-7 are average values. The viscosity of some reservoir liquids may be above, or below, the curves. The curves should not be used in lieu of laboratory data because the curves can be 100 per cent wrong.

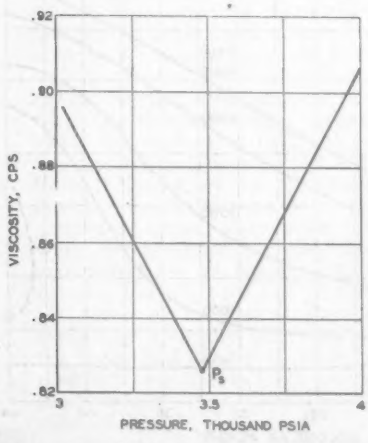


Fig. 18-6—Viscosity vs. pressure at reservoir temperature for an unsaturated reservoir liquid. P_s is saturation pressure

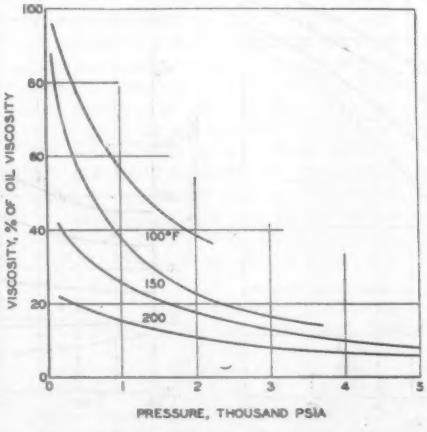


Fig. 18-7—Viscosity in per cent of oil viscosity at standard conditions vs. pressure and temperature for reservoir liquids at bubble-point pressure

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New Type Casing Shoes Pack Off Bottom of Hole During Cementing

by Kenneth B. Barnes

Sometimes, after cementing an intermediate string which has been suspended in the hole, or an oil string on top of a pay, a cement plug is found below. When this occurs for the former, extra drilling time is required, for the latter, some of the pay zone may remain "sheathed" or isolated from production. In this article new developments for packing off the lower hole during cementing are described.

SUBSTANTIAL downward movement of cement beyond the "normal turning point" below the shoe sometimes is a troublesome and jeopardous sequel to cementing casing. Two things are involved: the drilling expense of removing the extra cement, and the possible danger of some of the cement plugging part or all of the pay formation and shutting it off from production. Finding a considerable length of set cement below the casing shoe, furthermore, is particularly disconcerting because normally it is not to be expected. However, to predict, in advance, that subsurface conditions in a well are such that some cement will "go down" rather than for all of it to "turn" within 3 to 5 ft. below the shoe is, for most purposes, practically impossible.

A new type "packer - and - side-port" casing shoe has been developed by one manufacturer which has performed exceptionally well in numerous field installations in alleviating possibility of occurrence of the above factor. Development and design were done with assistance and cooperation of a number of oil-company drilling engineers intent upon obtaining a suitable mechanical safeguard which would be specifically designed to block off all the hole below the casing during the cementing procedure.

Part of the stimulus involved in the development of the new casing shoe was due to drilling engineers previously finding that in certain wells some cement had gone on to bottom and partially sheated or obstructed the pay formation. In one particular case complete plugging of the pay occurred, although it was unknown at the time, and the well was drilled ahead and completed in lower productive sections.

The new cementing tool, made in two slightly different designs, in short time has been field tested under a variety of drilling and completion conditions in Kansas, Illinois, Oklahoma, Texas, and Mississippi. Spot checks of details of a number of the jobs wherein it was used in different areas indicate a high degree of successful mechanical and operational applications.

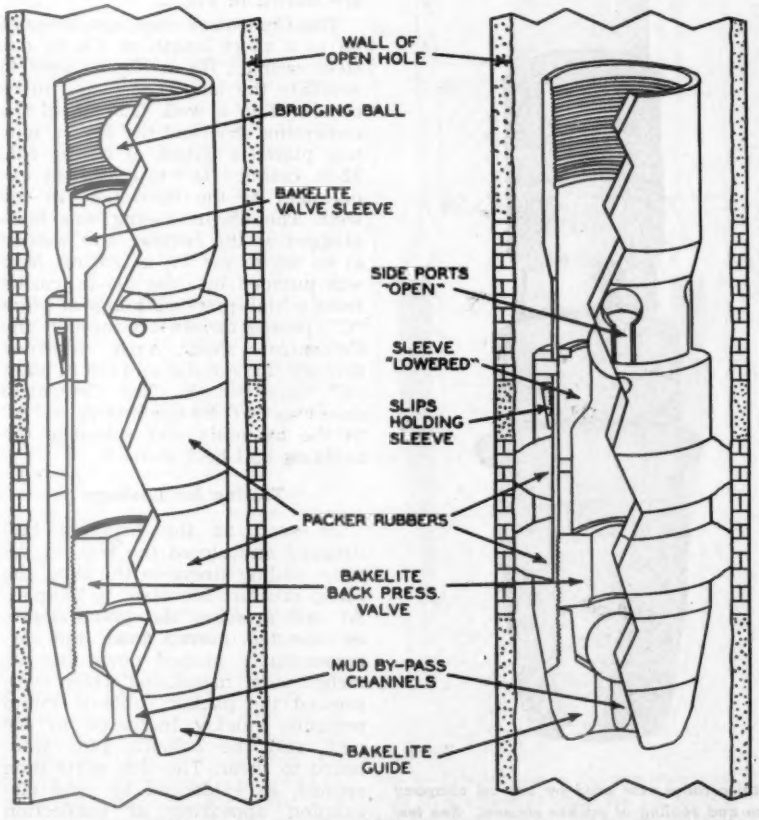

Fig. 1—Isometric drawings of the new full-hole-type packer shoe, in running position (left) and (right) in position and set, ready for cementing operation

Construction of Full-Hole Shoe

In Fig. 1 are given two isometric drawings of the "full hole" type cement packing shoe, designated as the "Cementrol" shoe by the manufacturer, Larkin Packer Co. of St. Louis. The left view gives the design of the makeup assembly positioned at the casing point but before the tool is set. On the right is illustrated the shoe after it has been set and in position ready for the cementing operation.

The full-hole-type shoe is comprised of two main parts. One of these parts, in some respects, is not unlike a regular cementing shoe. The bottom portion has an internal bakelite guide and back - pressure valve, the same as a conventional float shoe. Above, on the outside, are two packer rubbers separated by a steel wedge ring. In the same unit, above the packer rubbers, are four keyhole-shaped slots.

Sliding Sleeve and Packer Ring

The other principal unit of the Cementrol shoe consists of a bakelite sliding cylindrical sleeve which, in

closed position, covers the four side ports of the shoe unit. The sliding sleeve contains a seat for a ball-check valve. The sleeve is fastened, with four bakelite shear pins extending through the ports, to an outer steel ring which rests on top of the packer rubbers and by downward movement will compress and expand them outwardly.

As long as the sliding cylindrical sleeve covers the four side ports mud can pass only downwardly through the shoe in the same manner as in a regular float or guide shoe. Rubber gaskets are inserted in the top of the bakelite sleeve to prevent mud or cement bypassing it on the outside.

Inserted in the outside metal ring that compresses against the top of the packer rubbers is a slip-type lock to keep the rubbers expanded and the ports open once this action has taken place.

Running and Setting of Shoe

Casing is run to the desired point with the packer shoe on bottom in the same manner as is done with the regular float or guide shoe. Circulation may be established as necessary both before and after reaching the desired cementing position.

The packing element is set by dropping a 2¾-in. diameter lead-weighted bakelite ball from the surface down through the casing. To speed the fall of the bridging ball the mud pump usually is started and the ball pumped to its setting position in the tool. When it arrives, and further passage of mud through the bakelite sleeve is stopped, the design is such that pump pressure of 200 to 300 p.s.i. will then push down the inner sleeve. With the inner sleeve being connected by the four shear pins to the outer ring, the applied pump pressure thus asserts a downward force to expand the packing rubbers.

At the time full expansion of the packer rubbers has occurred, the inner bakelite sleeve has traveled downward sufficiently to where the four bakelite connecting pins have reached the end of their travel, and they shear off.

Opening of Side Ports

The design of the relationship of the shear pins, slots, movable sleeve, and side ports in such that the ports themselves are not open until the shear pins have broken. The action is automatic with the pumping, as with continued pumping there is no opening for relief and the pressure consequently builds up to a point where the pins are sheared. The breaking occurs at a pressure of 700 to 800 p.s.i. As the pins shear, the sliding sleeve drops on to its lowermost position and fully exposes the four side ports. At this point all of the hole below the packer rubbers is completely blocked off from further circulation. The cement slurry is introduced at the surface and pumped down the casing string and out through the side ports. In this manner the cementing job is done as usual except that all the cement goes out the side ports and the hole underneath is packed off from the cementing pressure.

After the shoe is set, care must be taken not to raise or lower the pipe and damage the packer seal. A float collar cannot be run with the packer shoe because the bridging ball must pass to bottom. Consequently, with no back-pressure valve in the pipe above the side ports, it is essential to hold pressure on top of the well to stop back-flow until cement has set.

Experimental Testing of Setting Action

In the course of development of the full-hole-type shoe an interesting experiment to investigate the setting properties of the assembly was made by one major oil company. Details of the arrangement employed are shown in Fig. 2.

The Cementrol shoe was screwed on to a short length of 5½-in. o.d. steel casing ("B" in Fig. 2) used to simulate the length of casing to be cemented in a well. Outside of the cementing shoe and the 5½-in. pipe was placed a length of 8⅝-in. o.d., 32-lb. casing ("D") to act in the experiment as the open hole in the well. The 8⅝-in. casing was bull-plugged at the bottom, and welded at its top to the 5½-in. casing. Mud was pumped into the 5½-in. casing from a high-pressure pump at point "C", passed downward through the Cementrol shoe, and returned through the annulus and out at point "E". (See Fig. 2). The Cementrol shoe was "set" by opening valve "A" in the assembly and releasing the bridging ball held above it.

Testing for Leakage

As soon as the bridging ball dropped and closed the seat on the inner sliding sleeve in the shoe, the pump pressure increased to 250 p.s.i. At this pressure the inner sleeve, as expected, moved down and correspondingly pushed down the attached outer metal ring which compressed the packer rubbers. Pump pressure quickly increased to 800 p.s.i. and the bakelite pins were heard to shear. The side ports then opened, as evidenced by mud circulation appearing at connection "E".

At this point in the experiment it

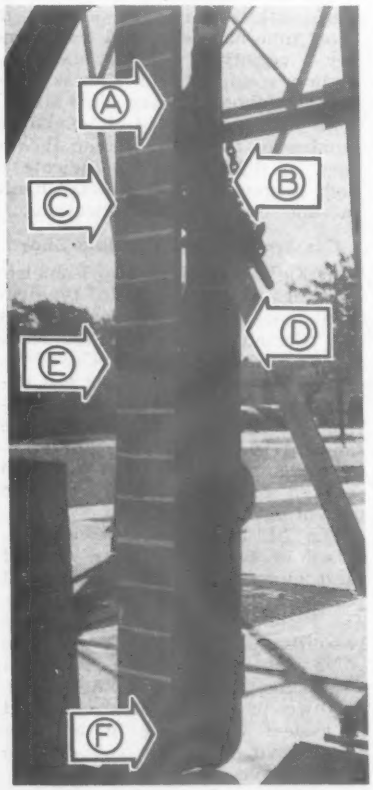

Fig. 2—(Left) Photograph showing experimental arrangement used by one oil company in testing the Cementrol shoe for setting action and sealing of packer element. See text for description of parts. Fig. 3—(Right) Appearance of shoe and packer element in set (open port) position after withdrawal from testing equipment

was desired to determine whether the packer rubbers were effecting a good seal and whether the seal would withstand a substantial differential pressure. Accordingly the space below the shoe was opened to the atmosphere at connection "F" and mud pressure applied at "E". It was found that the packer rubbers had made seal and a differential pressure of 675 p.s.i. was applied at "E" (or on top of the packer rubber) without leakage. In other similar hydraulic tests the packer seal obtained has been tested at pressures slightly in excess of 900 p.s.i.

Appearance of Set Shoe

The appearance of the packer shoe after the experiment is shown in Fig. 3. The pronounced sealing bulge of the packer rubber, which position is held by the slips inside the outer ring, is clearly visible, together with the side ports in open position and the connecting slots and holes for the shear pins. It should be mentioned that the shoe shown in Fig. 3 was one of the earlier models where only one packer rubber was employed. From experimental and development work, such as the above, it was found desirable to use two shorter packer rubbers separated by a steel wedge ring. Illustration of the shoe given in Fig. 3 is made only to complete the description of the results of the setting experiment discussed above.

Reason for Cement Not "Turning"

As mentioned at the outset, the "normal turning point" of cement to the upward direction is about 3 to 5 ft. below the bottom of the casing. Such usual occurrence has been observed on thousands of cementing operations in past years. In the cases where some of the cement continued downward and set up in the hole well below the bottom of the casing, the basic reason or physical explanation is in the presence of an underlying permeable formation or formations into which some fluid flow occurred during the cementing, and which subsequently prevented normal 100 per cent upward circulation of the cement. In other words, during the cementing some fluid flow was downward and into the permeable sections, and with some cement thus going in that direction as well as in the regular circulation up the annulus.

First Used on Arbuckle Wells in Kansas

Because the more prevalent and the greater the permeability of formations exposed to the hole under the casing point while cementing, the greater are the chances for "downward movement" of cement. It was not surprising, therefore, that first development of the Cementrol shoe was in completing wells of the Arbuckle dolomite in western Kansas. In this area common practice of quite a few operators is to drill rotary hole to the top of the Arbuckle, and then either drill or core in a short distance to look for oil-stained porosity, one good criterion for the obtainment of a productive well in this formation. After penetrating the porous pay for a few feet, casing is swung on top of the Arbuckle and cemented.

Arbuckle dolomite, where porosity occurs, quite often is very permeable, and in such cases the exposed hole below the casing seat can offer large permeable capacity or a good-sized "leak." Oil-company engineers engaged in handling completion for wells of this kind began on work for methods of isolating the exposed productive section from the cementing operation, and the procedure described above in part led to the present design of the full-hole shoe. For wells completed with a rat hole into the formation, the other and earlier design of the device, designated as the formation pack float shoe model, is available. This design is illustrated in Fig. 4. Operation is the same except that the lower side of the packer rubber is set down against the edge of the rat hole after the bridging ball is landed.

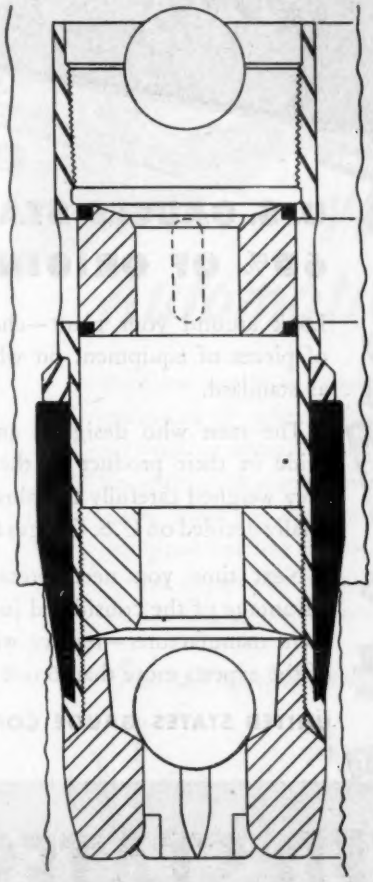

Fig. 4—Cross-section of the formation pack float shoe model, in which the packer rubber sets against the edge of the rat hole

Specific Installations

One company working on the packoff arrangement had noticed in completing a particular Arbuckle well in west Kansas several years ago, that the well from core and drill-stem tests had been indicated to be an especially good producer before pipe was run and cemented. The casing was run and cemented at the top of the formation in the usual manner, but after drilling cement plug and cleaning out the 10 ft. of penetration which previously had been made, no fill-up was found. Although this was a surprise to the operators at the time the only course indicated was to deepen ahead.

At a point several feet deeper a moderate fill-up was found in another pay and the well was completed for a small producer in that section. The completion was a disappointment in that the good production found at the top of the Arbuckle in surrounding wells was not obtained. Several years later, in reviewing completion record of the above well, it was discovered that showings of cement had been reported in the cuttings after the normal plug length had been drilled.

Becoming convinced that there had been good possibilities of the formation of a cement sheath along the walls of the higher producing section, the operator decided to acidize the upper section and to try to improve the exposure of that interval for production. This was done, in fact, the upper interval was acidized four times, using jet-gun process. After the last sweep, a regular acid job was applied and the pressure broke through. Subsequently, an excellent producer was obtained from the upper section alone.

Second Location Offset

On more recent drilling in the same neighborhood, a second location from the above re-worked well was drilled and the cement packer shoe employed on the bottom of the oil string. Top of the Arbuckle was encountered at 3,612½ ft. and cored to 3,619 ft. total depth. The core holes in the pay were reamed to full 7⅞-in. size to 3,619 ft. The casing string, with a baffle collar at the top of the bottom joint and Cementrol shoe on bottom, was run to bottom. Circulation was established and a small bridge off bottom easily washed out.

Pipe was picked off bottom to a desired setting point. The bridging ball was pumped down and the speed of the pumps reduced as low as possible in order to detect when

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the ball seated. At that time there was an almost instantaneous buildup of pressure to 300 p.s.i., then a momentary delay at 300 p.s.i. followed by a gradual buildup to 800 p.s.i. at which time the pins sheared and pressure dropped to zero. Circulation was continued, cementing operations started and 100 sacks of cement run. The top cementing plug was inserted and pumped down, followed by a measuring line to where the plug reached the baffle point and stopped. At this point the pumps were shut down, the valves closed, and the steel line removed from the well.

In this case very careful observations were made as the cement plug was drilled. No cement was found below the depth of the shoe. This particular company since then has run approximately 40 of the rat-hole-type formation-pack shoes and 10 of the full-hole type.

Cumberland Pool

Other areas of interest where the Cementrol shoe already has been used to some extent are in the Cumberland and West Edmond pools in Oklahoma, as well as at a number of North Texas points. At Cumberland, on oil strings of approximately 5,500 ft., it was the former practice of one operator to expose a total of about 100 ft. of productive sections before running and cementing casing. In order to protect the over-all productive interval from possible cement intrusion, a quantity of fibrotex, cotton-seed hulls and aquagel, was mixed as a special mud and spotted at the bottom of the hole. This was somewhat troublesome and time consuming, particularly in cleaning up afterwards for final completion. Experimental work with the full-hole packer-type casing shoe was done, setting the packer elements against a hard lime section present just above the foremost productive zone. First installations functioned successfully and the packer type cementing procedure consequently used in later wells.

West Edmond

At West Edmond, one operator found both the Bois d'Arc and Chimney Hill sections of the Hunton productive. In the first well, pipe was swung and cemented above the Chimney Hill and that pay tested first. After the cement plug was drilled, the operator found cement in the underlying hole and employed rotary wall scraping to clean out the sheathing which was indicated. In the second well, however, the operator used one of the full-hole packer shoes on the end of the casing string which was cemented on top of the Chimney Hill. In this instance the well kicked off without difficulty and registered an initial gage of 2,460 bbl. of oil per 24 hours, much better than the first completion. Both wells subsequently were gun perforated for production in the Bois d'Arc.

Pauls Valley Area

In the Pauls Valley area of southern Oklahoma, a new well in shallow territory was reported by one operator to have had 8 ft. of open hole below the oil string when it was cemented. After drilling cement plug, the well produced approximately 50 bbl. per day, and no improvement over that rate could be made by subsequent cleaning-out operations. There was some indication that cementing sheathing of the formation had occurred from fluid leakage into the section while cementing, so the operator shot the 8 ft. of exposed sand section with 60 bullets from a gun perforator. While the increase possibly could have come, of course, from the action of the perforating bullets themselves, the well did respond much better and was completed for a rate of 150 bbl. per day.

Deep Wells

Other reports of the cement-packing shoes come from widely scattered areas, and it is noteworthy that a good many are being used in fairly deep wells. These include Fullerton at 7,600 ft., West Moore at 8,800, and Sheridan at around 11,000 ft.

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Improvements Increase Efficiency of Fluid Catalytic-Cracking Process

by E. V. Murphree, C. L. Brown,† E. J. Gohr,‡*
C. E. Jahnig‡, H. Z. Martin‡ and C. W. Tyson‡

Details and "know how" of the reactions and operations of a new type of process are all-important for its successful operation and the accompanying article includes numerous data not heretofore published in assembled form. The Fluid catalytic-cracking process is two-stage, the reaction step and the catalyst regeneration step. Only 0.5 per cent of the total catalyst circulated must now be recovered, reducing losses and simplifying recovery equipment and methods. Running periods of 8 months are set up for some new units; erosion is of minor magnitude.

A COMPARISON of the old and the new fluid catalytic-cracking methods, which have been termed "upflow" and "downflow" operation, respectively, is shown in Fig. 1. In both cases pressure required for the flow of solid material from a low-pressure source to a zone of higher pressure is attained by means of a standpipe. The fluid mixture enters the top of the standpipe in a fairly dense condition favorable to building up static pressure and as it passes down the standpipe its density tends to increase since the fluid is compressible. To avoid attainment of densities at which bridging and uneven flow would result, it is desirable to add aeration gas along the length of the standpipe.

In the downflow principle illustrated in the left-hand portion of Fig. 1, the finely divided solid material under elevated pressure at the base of the inlet solids standpipe flows through a control valve into an injection zone where it is diluted by a suitable gas stream and blown into the reactor. The velocity in the reactor is greatly decreased so that the solids tend to concentrate in the gas stream. Under these conditions the solids form a dense, turbulent bed having a relatively clearly defined level. The velocity in the vessel is sufficiently low and enough disengaging space is provided above the level so that only a small amount of solids passes overhead with the gas. The reaction vessel is made large enough to afford the required reaction time in the dense bed of fluidized solids, and the major portion of the solids fed to the reactor is withdrawn through a well to the outlet solids standpipe.

This may be compared with the older and previously disclosed upflow principle illustrated in the right-hand side of Fig. 1 wherein all of the fluidized stream is taken overhead to dust recovery equipment. The advantages of the downflow arrangement are:

1. The problem of dust recovery has been materially reduced since only about 0.5 per cent of circulating solids stream must be recovered.
2. The level of solids and consequently the degree of contact in the reactors can be set at will. In upflow operation the solids holdup is a function of numerous operating variables.
3. The height of the supporting structure is less due to lower standpipe length because of less pressure drop in the fluidized solids circulation stream.
4. External hoppers are not needed since inventory changes are easily manipulated in the reaction vessels themselves.
5. The solids recovery equipment may be incorporated (in part at least) within the reaction vessels.

It is apparent from the above that the downflow system will provide lower investment as well as maintenance costs.

*Standard Oil Development Co. †Esso Laboratories, Standard Oil Co. of Louisiana. ‡Esso Laboratories, Standard Oil Development Co.

A paper presented before the American Institute of Chemical Engineers at the recent St. Louis meeting.

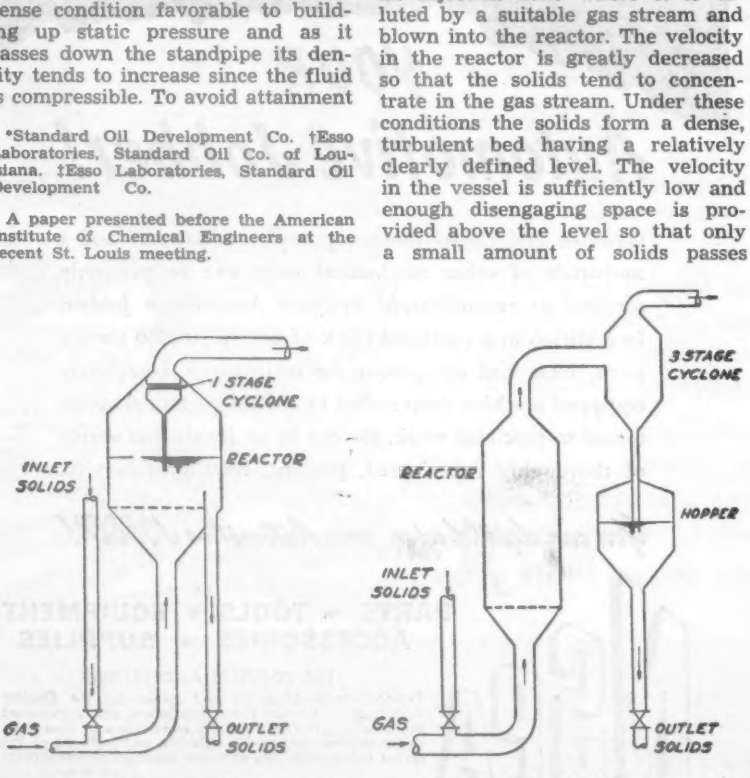

Fig. 1

New Design As Applied to Catalytic Cracking

Catalytic cracking of petroleum is essentially a two-stage operation. In the first step, the oil is contacted with the catalyst whereby the latter becomes fouled with coke. In the second stage, the catalyst must be burned free of this deposit. This is accomplished by the Fluid process as a truly continuous operation in which the fluid catalyst is continuously circulated without mechanical means between the reaction and the regeneration stages.

Catalyst flow.—Fig. 2 shows a flowsheet of a downflow type of Fluid cracking unit which is now in wide use. Catalyst enters the re-

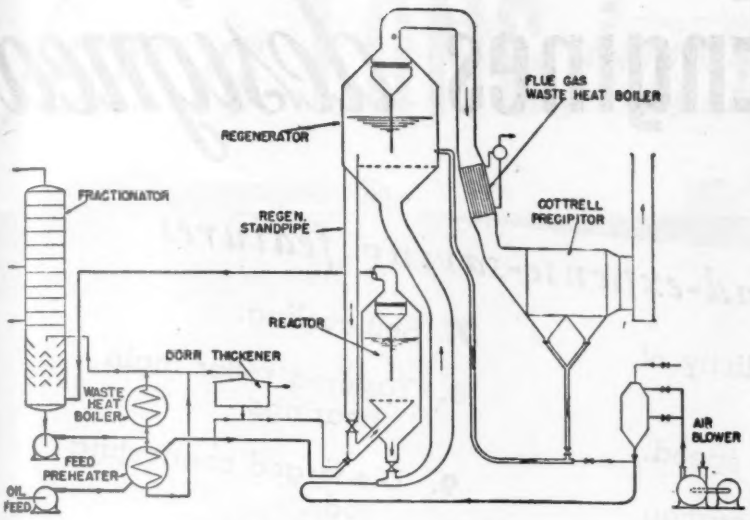

Fig. 2—Flow sheet of Fluid cracking plant

generator well and flows down through the regenerated catalyst standpipe through a slide valve into the reactor inlet line. The particle size of the catalyst normally used may vary between 5 and 50 per cent on 100 mesh. The catalyst is mixed with the oil at this point at ratios of 5 to 30 lb. of catalyst per pound of oil, depending on the specific conditions employed. It will be noted that on this basis large quantities of catalyst must be circulated, corresponding to approximately 8 to 50 tons per minute for a 15,000-B/D plant. From the injector the mixture flows upwards into the reactor where it mingles with the dense bed of fluid catalyst, which can be adjusted to such height as to obtain the degree of cracking desired. This vessel, in large Fluid units, may have a diameter of 25 ft. and a height of 50 ft. with a holdup of fluidized, turbulent catalyst amounting to as much as 75 to 100 tons.

The catalyst leaving the fluidized reaction bed passes into the bottom of the vessel where it is stripped of hydrocarbon vapor with upflowing steam injected into the bottom of the vessel. From this stripping zone the solid flows into the spent catalyst standpipe, through a slide valve for flow control and into a spent catalyst return line where it is mixed with air for regeneration and blown into the internally insulated regenerator. Here again the catalyst mixes in a dense fluid bed which is of such volume that sufficient time for the regeneration step is obtained. The regeneration vessels in 15,000-B/D commercial Fluid units ordinarily have a catalyst holdup of 150 to 300 tons. From this point the catalyst continues around the circuit again.

As brought out in discussing Fig. 1, high standpipe and low return line densities are maintained to facilitate catalyst circulation. High vessel densities make possible attainment of required reaction and regeneration contact times in reasonably sized equipment. It is of interest that the degree of settling of the finely powdered catalyst in the vessels is much greater than might be expected. For example, the average relative velocity of the catalyst with respect to the gas stream in the fluid existing in these vessels is found to be much greater than the velocity of free fall predicted by Stokes' Law.

Oil flow.—The oil to be cracked is pumped from storage through a set of heat exchangers in which it is preheated by a fractionator bottom stream to a temperature which may be varied between 100° and 400° F. The stream of heated liquid feed, which may vary in boiling range from naphtha to heavy crude fractions is injected into the stream of hot regenerated catalyst leaving the regenerated catalyst slide valve. The regenerated catalyst is at a temperature of 1,000° to 1,150° F. and causes very rapid vaporization and heating of the charge stock to cracking temperatures of 800° to 1,000° F. The fluid mixture flows into the reactor, which is ordinarily held at 8 to 12 p.s.i.g. Considerable flexibility in the severity of treatment is provided by simple regulation of the catalyst level in the reactor, or by change in the rate of catalyst circulation. Temperatures are uniform as a result of the heat capacity and turbulence of the fluidized catalyst mass.

The cracked product vapors leave the dense fluid catalyst bed and pass through a single stage of cyclone separators mounted in the upper head of the reaction vessel. In this equipment, the greater part of the small quantity of entrained catalyst particles is removed from the gas stream and returned through a dip pipe to a point well below the level of catalyst in the dense bed. This method of returning the recovered catalyst to the main circulating stream is simple and effectively prevents back flow of oil vapors.

The cracked products leave the

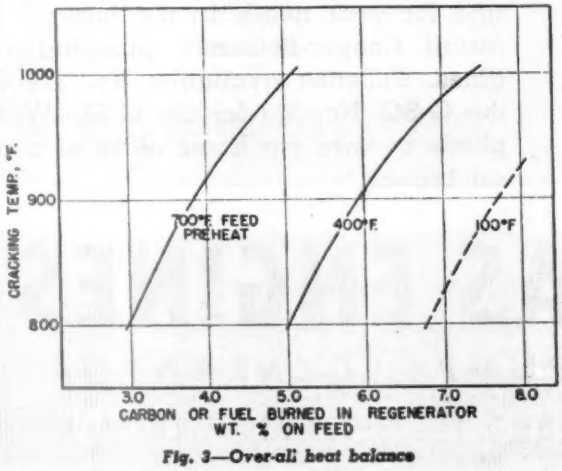

Fig. 3—Over-all heat balance

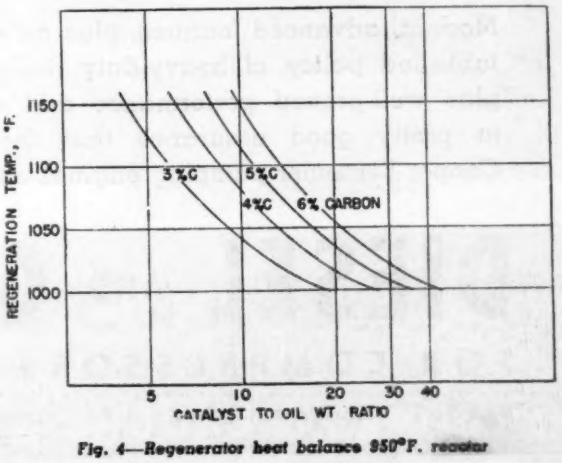

Fig. 4—Regenerator heat balance 950°F. reactor

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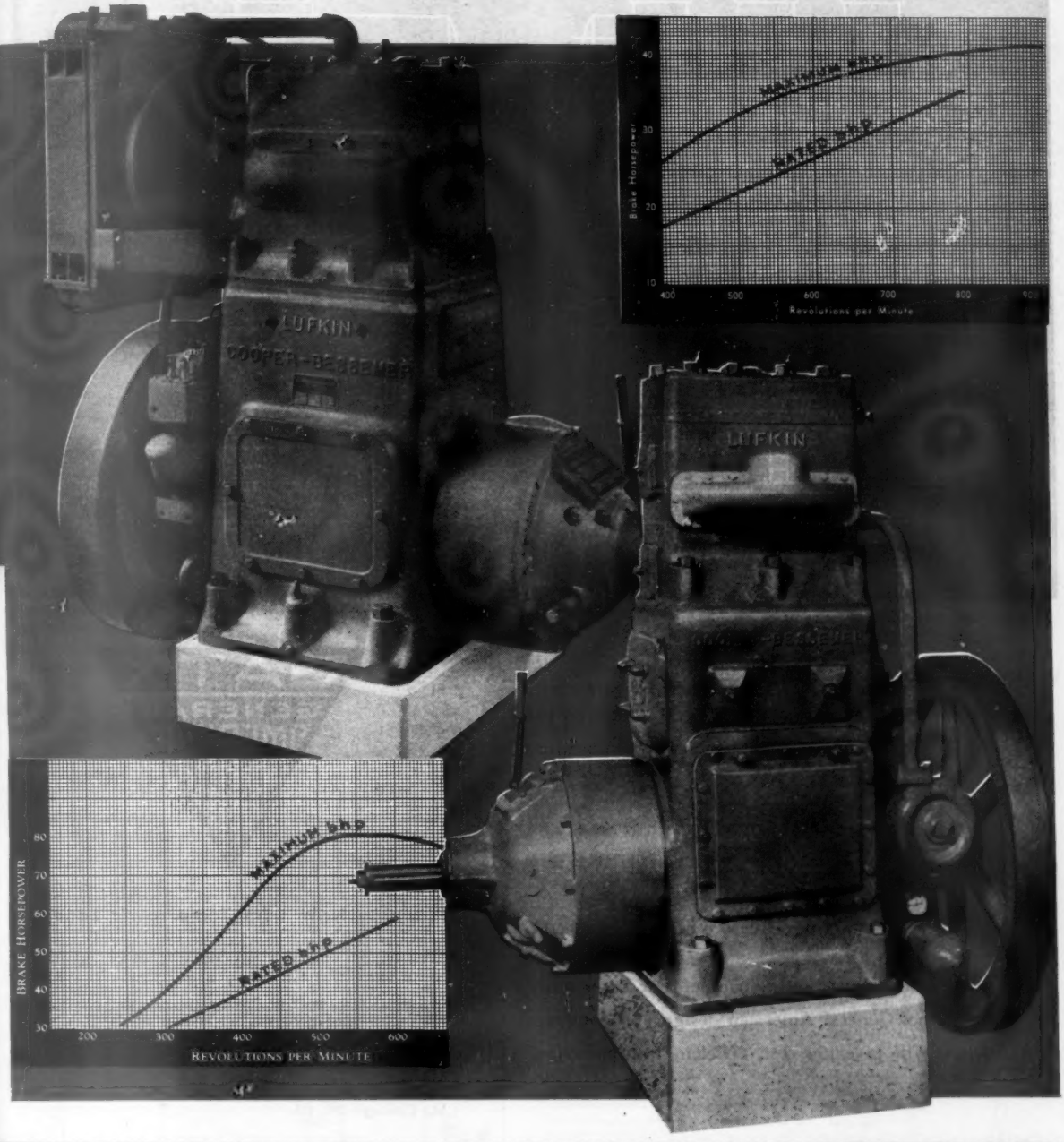

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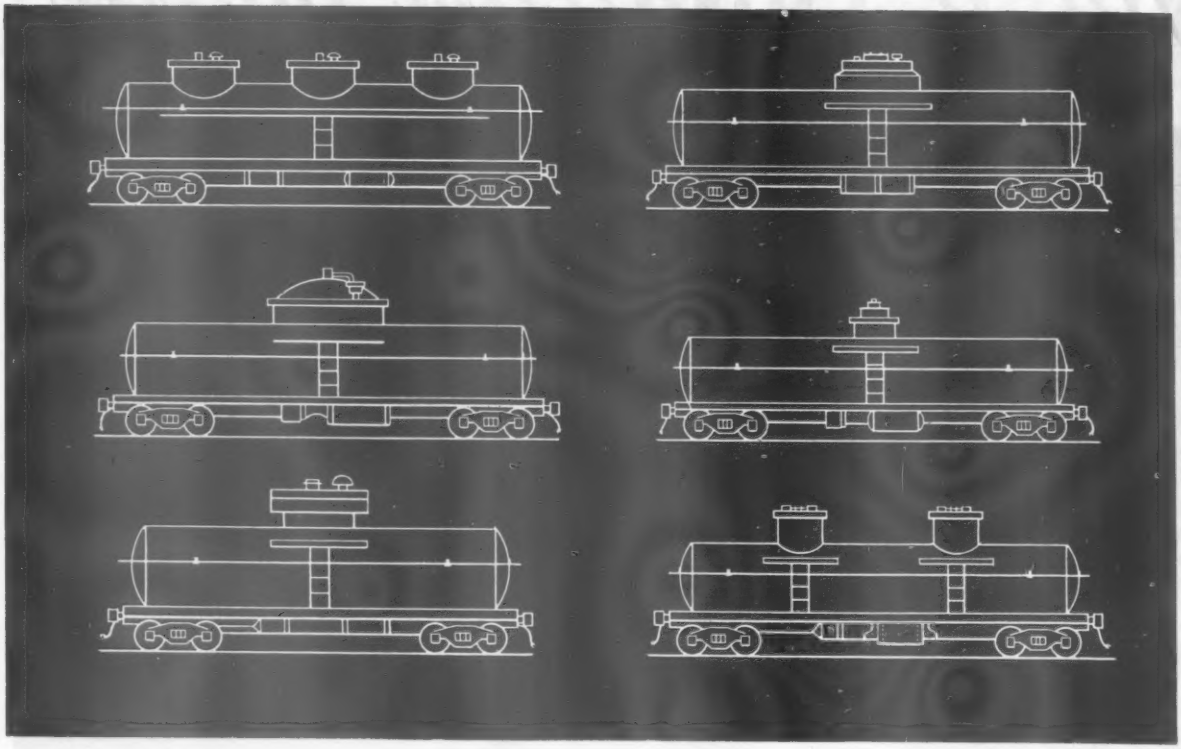

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top of the reactor and pass into the bottom of the fractionator. This tower is of conventional design for the most part and separates the products into a wet gas stream, light distillate, gas oil and cycle stock. The bottom of the tower below the usual bubble trays is fitted with five disk and four doughnut trays over which a stream of heavy bottom product is circulated. This stream removes heat from the oil vapors, cooling them to 550° to 600°F. and is then passed through a series of heat exchangers where it gives up heat in part to the fresh feed, any excess being used to produce high-pressure steam. In passing over the disk and doughnut section the circulating oil stream also scrubs out the remaining catalyst from the entering product stream and it is the resultant slurry of catalyst in heavy bottom product which is circulated over the disks and doughnuts and through the heat exchangers. The removal of dust from the vapors is virtually complete since no deposits are found on the bubble trays above the discs and doughnuts or in the side stream or overhead products.

A small portion of the circulating slurry stream is withdrawn for the recovery of the catalyst it contains. The quantity of this so-called "slurry return" is generally about 3 to 10 per cent of the fresh reactor charge and contains about 0.5 lb. of catalyst per gallon. The catalyst concentration of the slurry is controllable and may be decreased by increasing the rate of slurry return. By maintaining slurry concentration below 0.5 lb. per gallon, erosion of slurry pumps and valves is negligible.

Early practice was to send the slurry return directly to the reactor inlet line which obviously meant cracking a portion of the heaviest oil product to extinction and consequently led to high carbon formation in the reactor. Slurry return is now sent to a Dorr thickener where about 70 per cent of the heavy oil is removed as a clarified oil containing less than 0.01 lb. of catalyst per gallon. The thickened sludge containing most of the catalyst is mixed with fresh feed for dilution and pumped to the reactor inlet for recovery of the catalyst.

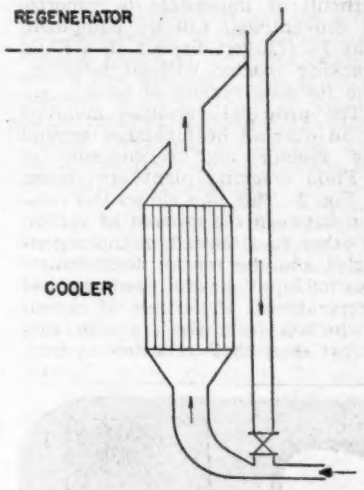

Fig. 5—Regenerated catalyst cooler

Air flow.—The air-flue gas system starts at the turbo-blowers where air for regeneration is compressed to 13-15 p.s.i.g. The air flows through an auxiliary burner, used for starting up the plant, and then to the spent catalyst return line where it dilutes the solids flowing from the spent catalyst standpipe and enters the regenerator. Here the coke deposit on the spent catalyst is burned at a temperature of 1,000-1,150°F., the carbon content of the catalyst being reduced to less than 1 per cent and generally to about 0.5 per cent. Pressure in the regenerator is ordinarily maintained at 2 to 4 p.s.i.g. The resulting flue gases plus a small amount of entrained catalyst leave the dense bed of catalyst and pass through a single stage of cyclone separators where most of the catalyst is recovered and returned to the dense bed through a dip pipe as described in connection with the reactor. The hot flue gases then leave the regenerator containing a small quantity of catalyst and pass through a waste heat boiler where the gases are cooled to about 600°F. and byproduct high pressure steam is produced. For a final cleanup, the flue gases are treated in a Cottrell electrical precipitator from which they are discharged to the atmosphere with a solid content of about 0.15 grains per cubic foot. The fine catalyst recovered in the precipitator drops into a set of hoppers from which it is returned to the regenerator through a standpipe system.

Catalyst storage.—Two storage hoppers are provided, each large enough to hold the entire plant inventory of catalyst. By imposing air pressure above the catalyst bed in the hoppers and operating them as blow cases, catalyst may be added to the system at superatmospheric pressure. The catalyst flows from the bottom of the storage hopper into a stream of air from the regeneration air blower and this mixture is introduced into the spent catalyst return line.

Catalyst can be removed from the base of the regenerated catalyst and Cottrell standpipes and conveyed in a stream of air to the storage hoppers. In order to avoid the necessity of designing the storage hoppers to withstand the high temperature conditions existing in the regenerator, the air-catalyst mixture can be passed through a cooling coil where its temperature is lowered to 150° to 250°F. before it reaches the storage hoppers. Another and perhaps more satisfactory technique when shutting down a plant is to cool the catalyst in the regenerator before removal, by blowing with air after the carbon has been burned off completely.

Heat Balance

In addition to the ability to transfer large quantities of solids from one zone to another the fluid technique is of particular interest for

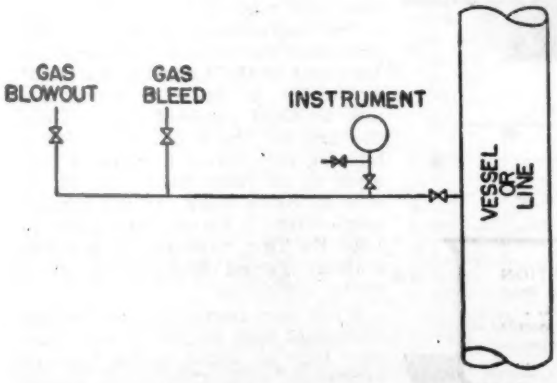

Fig. 6—Pressure connection

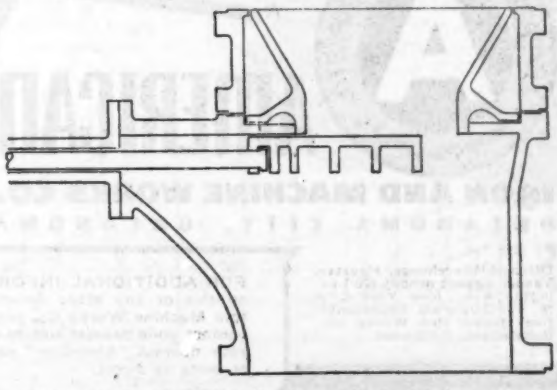

Fig. 7—Slide valve for catalyst control

its ability to transfer coincidentally large quantities of heat. In many Fluid catalyst cracking units a transfer of over 150 million B.t.u./hour from the regenerator to the reactor is regularly carried out. By this means the heat of regeneration is dissipated and at the same time used to supply the heat required for preheating, vaporizing, and cracking the oil. This is accomplished by direct contact of oil with hot regenerated catalyst, which provides a very satisfactory means of heating hydrocarbons and eliminating expensive heat exchange surface. Thus, feed stocks which are difficult or impossible to vaporize in conventional tubular equipment may be charged directly to a Fluid cracking reactor without interruption for long periods of time.

The principal variables involved in an over-all heat balance around the reactor and regenerator of a Fluid cracking plant are shown in Fig. 3. This plot shows the relation between the amount of carbon or other fuel burned in the regenerator and the reactor temperature obtainable at several feed preheat temperatures. If the rate of carbon production from the cracking step is less than that indicated as necessary by the curves, the deficiency may be made up by adding oil fuel to the regeneration system. In general practice the use of extraneous fuel is not required for heat balance since more war products can be made by using the entire regeneration system capacity for burning catalytic carbon. In those plants not equipped with furnaces for preheat, feed temperatures between 100° and 400°F. may be obtained and any combination of cracking temperature and carbon burning rate lying in the area between the 100° and 400°F. lines is possible in so far as overall heat balance is concerned. For example, 900°F. cracking temperature may be maintained with carbon burning rates varying between 5.9 and 7.7 per cent on feed.

In all probability, peacetime operation will demand a less severe degree of gas oil conversion and the per cent of catalytic carbon on feed will be lower than is present practice. The deficiency in carbon production may be supplied either by the use of extraneous fuel in the regenerator or by supplying the extra heat as additional preheat in the feed. Since there are limitations in the regeneration system such as air blower capacity, etc., greater plant processing capacity may be obtained by the addition of a preheat furnace. If, for example, the furnace is sufficient for maintaining a 700°F. oil preheat temperature, the flexibility as regards overall heat balance will include the entire area between the 100° and 700°F. lines.

Since the heat produced in the regenerator is consumed in the reactor, a heat balance drawn about either of these elements will serve to indicate the magnitude of heat and mass transfer required to satisfy the conditions assumed. In Fig. 4 the relation between catalyst circulation rate expressed as catalyst to oil-weight ratio and regenerator temperature is shown for the case of 950°F. reactor temperature. A family of lines representing carbon burning rates of 3, 4, 5 and 6 per cent on feed is presented. These lines indicate that catalyst circulation rates may be increased sharply as the regenerator temperature approaches the reactor temperature. This fact is the basis for the great flexibility in catalyst circulation rate in Fluid cracking units. Thus, the line for the 5 per cent carbon burning rate covers a range of catalyst to oil ratio from 8 to 35, or over four-fold when the regenerator temperature is varied from 1,150° to 1,000°F. This variation is possible without altering other primary processing conditions.

It has been pointed out above that additional heat to satisfy heat balance may be added in the form of extraneous fuel. Conversely, excess heat may be removed by incorpo-

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rating a regenerated catalyst cooler as is shown in the design of Fig. 5. By this means a part of the heat of regeneration is transferred to boiling water and catalyst circulation may be reduced correspondingly. Thus, catalyst to oil ratios may be reduced to any desired value below those shown in Fig. 4. However, a corresponding amount of furnace capacity may have to be added to satisfy the over-all heat balance conditions set forth in Fig. 3.

The extreme flexibility in catalyst to oil ratio, in addition to the possible variations in reactor holdup already mentioned affords a large change in the severity of cracking. Since the degree of conversion may be increased by increasing catalyst to oil ratio or reactor holdup, coincident use of both of these variables may be made in order to attain the best suited cracking conditions for any particular type of operation on stocks of widely differing characteristics.

Specific Design Features

Instrumentation.—The instrumentation in a Fluid plant is unique in that it involves the measurement and control of pressures, flows, and levels in lines and vessels containing dust. Fig. 6 shows the piping required for a pressure tap for actuation of such instrumentation. It consists of a connection to the point of measurement, into which a small quantity of gas is bled continuously to prevent plugging with catalyst, and a line to the pressure gage or other instrument. A line for cleaning out the tap by a blast of high-pressure gas is also indicated. Catalyst holdup is measured by two such taps installed at the top and bottom of the vessel. From the pressure differential thus measured the weight of catalyst between taps can be calculated. To measure the density in the bed, two or more taps must be located in the dense bed and by such an arrangement the catalyst level can be located.

Catalyst-flow rate can be measured by heat balance around one of the vessels or by a carbon balance, the latter method involving calculation of the rate of carbon burning from the air-quantity and flue-gas analysis in addition to a carbon analysis of both spent and regenerated catalyst. For instantaneous indication of flow rate, the catalyst and gas stream can be passed through an orifice or venturi meter, the readings on which are a function of the catalyst concentration of the gas stream. For moderate pressure drops the simplified venturi meter equation has been found to apply to cases where gas-powder mixtures are being metered if the fluid density used is that of the flowing stream. Another more qualitative method has been devised wherein the air rate to the spent catalyst injector and the pressure differential across a measured vertical length of the spent catalyst return line are used. This pressure gradient has been found to depend on the catalyst circulation rate, other factors remaining unchanged, and the device is a very useful indicator of catalyst flow changes.

Slide valves.—Fig. 7 is a sketch of the slide valve used for control of catalyst flow. These valves are simple and rugged and have been found to give little trouble. The plant has a common circulating oil system for motivating these valves through piston operators. The valve is designed to have a large open space underneath so that catalyst accumulations cannot build up and prevent movement of the slide. In 2½ years of operation no case of plugging or binding of the valves is known to have occurred.

Catalyst recovery.—Some of the plants are equipped with "multiclone" type cyclones licensed by the Western Precipitation Corporation. These consist of an assembly of small cyclones operating in parallel and mounted in the upper heads of the reactor and regenerator. The collected dust falls into a common hopper located below the multiclones and is returned to the dense catalyst bed through the dip pipes, as already discussed. Cyclones manufactured by Buell Engineering Co. are also in use.

The Cottrell precipitator is arranged for horizontal flow of the gases and the collected dust falls into hoppers below the Cottrell proper. The Cottrell should be operated at 400°F. or lower for best results, compared with the optimum flue gas outlet temperature from the waste gas coolers of 600°F. A system of superheated water spray injectors in the Cottrell inlet line is employed to get down to the desired temperature and at the same time avoid wet catalyst accumulation. Water vapor in the gases to the precipitators is maintained at 20 to 25 per cent by volume to help prevent arcing. During the early operation of the 15,000-B/D units it was learned that the addition of 6 to 10 lb. per hour of ammonia vapors or about 0.005 per cent by weight of the flue gas caused an additional marked increase in efficiency. This striking result is believed to be due to an increase in electrical conductivity of the solid material, permitting release of its charge to the collection plate more readily.

Plant Performance

There are in operation in the United States 36 Fluid cracking units having a total nominal throughput of about 400,000 B/D. Of these, all but four are of the new downflow design. All of these plants are operating to produce aviation base stock and olefins for production of aviation blending agents or butadiene. The 15,000-B/D capacity for the plant referred to in this article represents a nominal design figure. A number of these plants operated by affiliates of Standard Oil Co. (N.J.) have exceeded this capacity by a considerable margin with one unit currently running as high as 25,000 B/D. Runs in excess of 6 months' duration have been made and present scheduled operating periods for units operated by Standard Oil Co. of Louisiana are set up on the basis of 8 months between shutdown periods, indicating that good service factors are obtainable.

Erosion in the downflow plants, in general, has been quite minor. Virtually no erosion has been experienced in lines since velocities have been adjusted with this in mind. In some cases erosion has been noticeable in the cyclone vanes and in the collection tubes adjacent to the vanes. This wear, however, has not been sufficiently serious to affect the operation of the units. A small amount of wear has been found on the gates of the slide valves, which of course are readily replaced during turnaround periods. The minor character of the erosion experience is borne out by the long running periods obtained on the downflow units.

Catalyst recovery is an important item in the operation of the Fluid catalyst units since this material is relatively costly. After initial operating conditions were adjusted, very

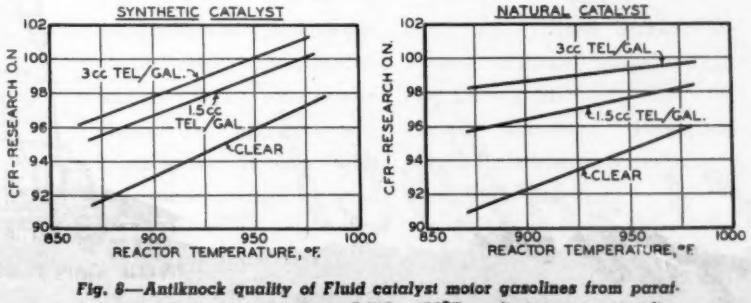

Fig. 8—Antiknock quality of Fluid catalyst motor gasolines from paraffinic gas oil feed stocks. Basis R.V.P., 400°F. endpoint motor gasoline

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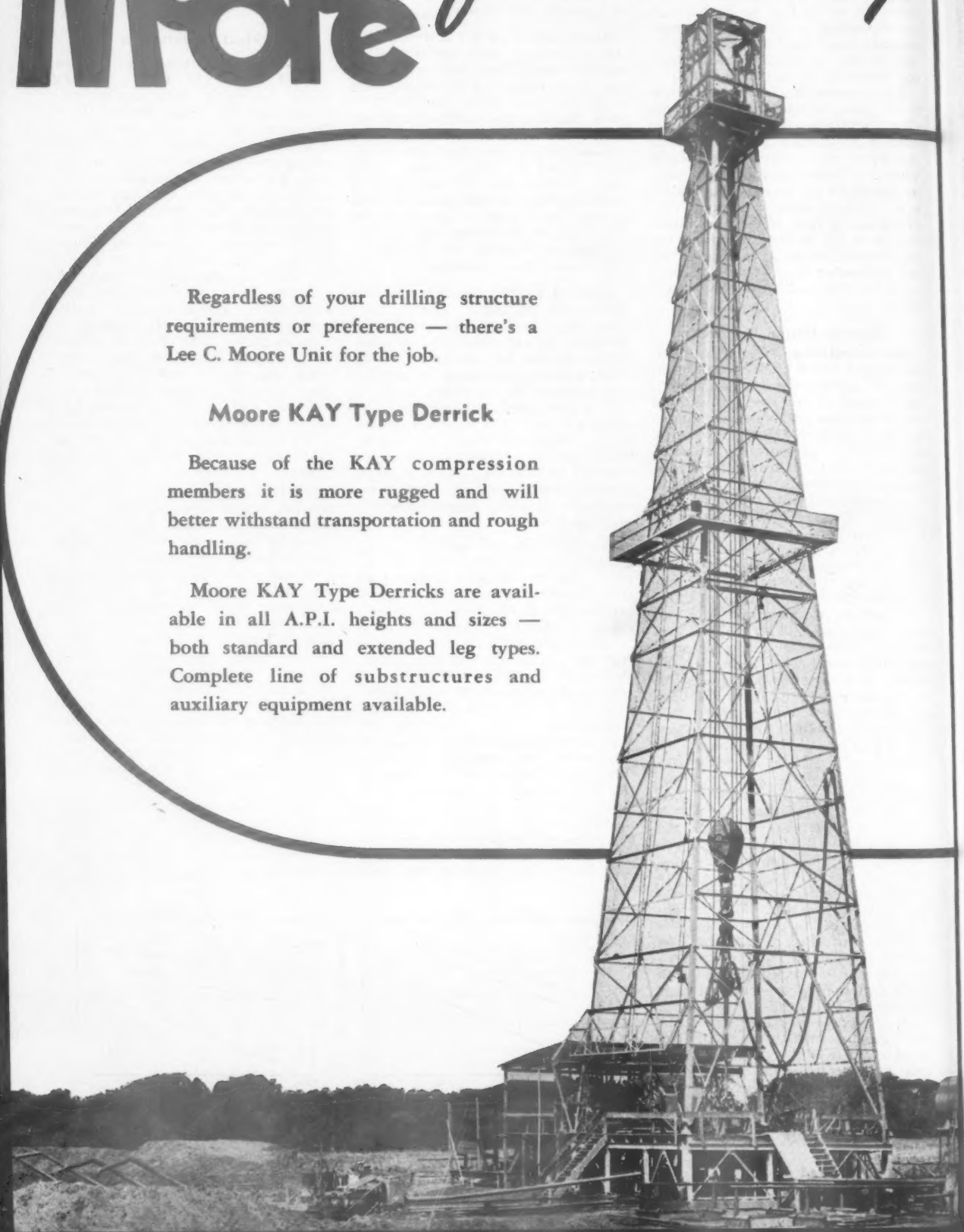

satisfactory catalyst recoveries were obtained on the downflow fluid units. The major catalyst loss is obtained in the flue gases leaving the Cottrell precipitator, the remainder representing the small amount of catalyst in the clarified oil leaving the slurry oil settler.

The following table shows actual catalyst losses obtained in several 15,000-B/D plants operated by affiliates of Standard Oil Co. (N.J.). The figures cover the total measured inventory loss for complete runs, including starting up and shutting down periods.

	Length of Run, Days	Avg. Tons Tons Per Day Loss
Standard Oil Co. of La.		
No. 2 Unit	181	3.3
No. 3 Unit	180	1.9
Lago Oil & Transport Co. Ltd.	183	3.6

The above figures and other information on current operations indicate a loss of 2 to 3 tons per day on the 15,000-B/D downflow plants. This loss may be appreciably reduced through modification in design.

Process Data

Maximum production of materials of war has been the prime objective in the operation of all Fluid catalyst plants. Cracking has accordingly been carried out for the most part at high temperatures with a synthetic type catalyst, charging gas oils once through at fairly severe levels of conversion. Thus, of the five plants of the improved type currently operated by the affiliates of Standard Oil Co. (N.J.), only the first was operated with a natural-type catalyst at the relatively mild conditions which are more representative of normal operations for the production of motor gasoline; this operation established in a short period the satisfactory performance of the new design, and little process data on this type operation are therefore available.

TABLE 1—YIELDS AND QUALITIES OF AVIATION COMPONENTS

Once-Through Cracking with Synthetic Catalyst-Commercial Downflow Fluid Plants

	Paraffinic	Naphthenic
Feed Stock:		
Gravity, °API	32.0	30.7
ASTM, 50% @ °F.	618	539
Diesel Index	57.0	46.3
Sulfur, Wt. %	0.34	0.16
Aviation Components:		
Base Stock (7# RVP), Vol. %	25.8	31.8
Excess C_5, Vol. %	6.6	0.0
Total C_5, Vol. %	11.8	8.9
Total C_4, Vol. %	17.5	15.9
Butylenes, Vol. %	8.7	6.8
Isobutane, Vol. %	7.0	7.2
Cracked Gas Oil, Vol. %	33.5	35.1
Quality of Untreated Base:		
Reid Vapor Press., #/Sq.In.	7.6	7.0
ASTM, % @ 293°F.	90.0	75.5
Bromine No., cg./G	65	47

TABLE 2—ACID TREATMENT OF FLUID CATALYST AVIATION BASE FRACTIONS FOR ANTIKNOCK QUALITY IMPROVEMENT

Paraffinic Gas Oil Feed

Catalytic Aviation Base Fraction	Light Naphtha Raw	Light Naphtha Treated*	Heavy Naphtha Raw	Heavy Naphtha Treated†	Calculated Blend Treated‡
Typical data					
Gravity, °API	65.9	66.4	36.9	36.4	44.3
RVP, #/Sp.In.	5.0	5.0	2.0	2.0	3.0
Bromine No., cg/G	87.5	55.1	17.3	3.6	
Sulfur, Wt. %	0.030	0.020	0.054	0.025	0.024
A.S.T.M. distillation					
I.B.P., ° F.	125	125	220	228	
10% at °F.	142	146	257	263	185
50% at °F.	158	160	288	289	270
90% at °F.	197	193	325	325	318
F.B.P., °F.	236	221	350	348	

*Treated with 15# of 93% H_2SO_4 per barrel raw naphtha.
†Treated with 23# of 90% H_2SO_4 per barrel raw naphtha.
‡Using production proportions.

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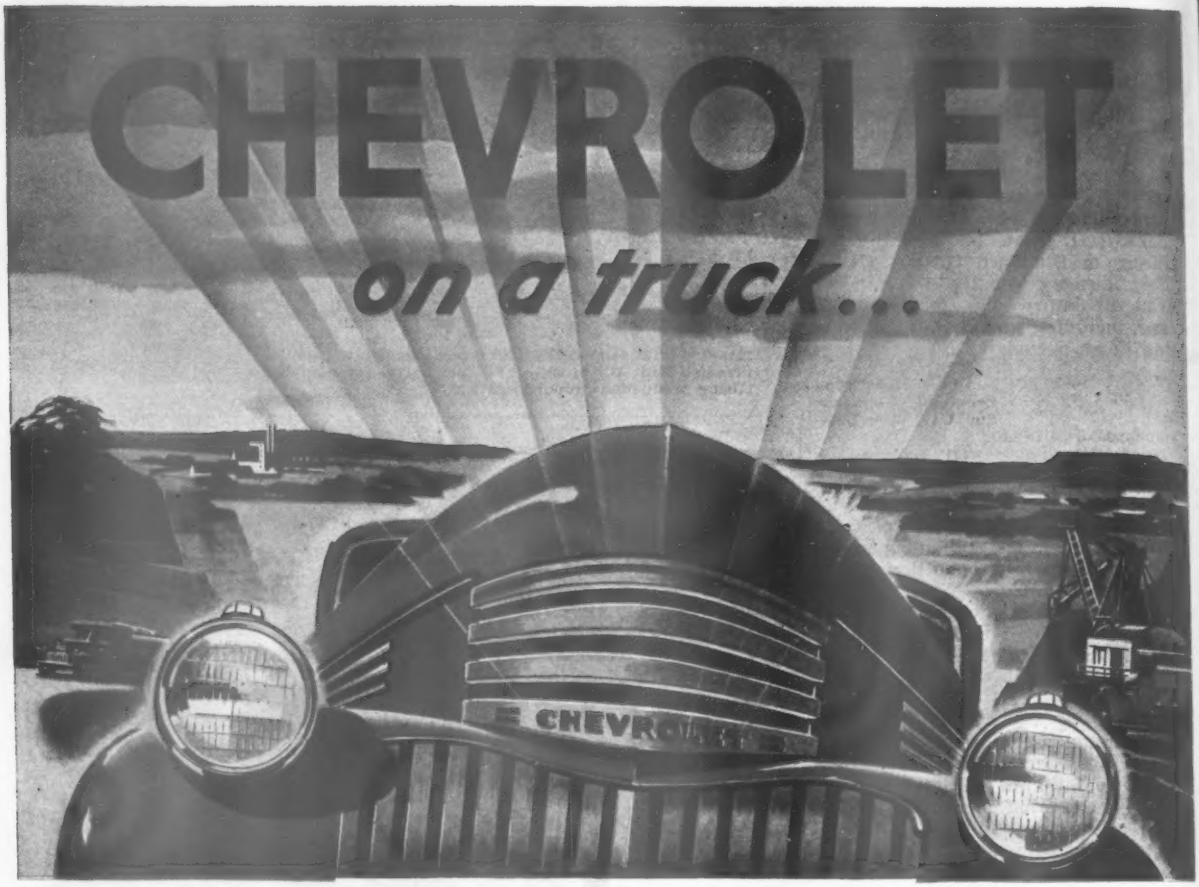

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Off-Specification Products

What is the extent of damage involved in the case of off-specification products? It's a hard job to convince anyone that such products should be shipped back 10,000 miles for a little retouching. Our choice is to use it or let it stay there as a complete loss. I hope that due to your experience and knowledge, you can give me some information—particularly about gum, distillation (50 and 90 per cent), saponification number, neutralization numbers, carbon residue and octane number.—G.R.W.

At this moment this editor has no authority to advise about the disposal of Army products, nor can the staff of The Oil and Gas Journal assume such responsibility. Nevertheless, unofficial counsel can be given by relating some of the definite findings of the industry. Obviously, the degree of the emergency or need is a powerful influence in making decisions about the disposal of products—and if a severe shortage exists then it can be stated that almost any product whose test properties do not indicate materials foreign to oils or which do not indicate serious deterioration (as might be the case with gum), may be used without extreme damage. More specifically, and with respect to various products:

Gasoline (automotive): Sulfur—only gives minor corrosion in tail pipe and muffler.

Vapor pressure—makes vapor-lock trouble somewhat as follows:

Climate	Reid Vap. Pressure—Noticeable	Reid Vap. Pressure—May stop engine
at 115°F.	5.5 — 6.5	8
at 100°F.	6.9 — 8.0	10
at 85°F.	8.6 —10.1	13
at 70°F.	10.7 —13.0	15

Ten per cent A.S.T.M. temperature—related to ease-of-starting, requires choking to start, engine may flood during starting, and engine dies easily, but not vital.

Climate	Maximum 10% Temps.
at —30°F.	96°F.
at —20°F.	106°F.
at —10°F.	120°F.
at 0°F.	138°F.
at 10°F.	154°F.
at 20°F.	171°F.
at 30°F.	188°F.

Fifty per cent A.S.T.M. temperature—related to acceleration and time for warm up. High 50 per cent points only result in sluggish performance. For Army 2-103B gasolines:

Climate—	Max. 50% Temps. Ideal	Max. 50% Temps. Reasonably Satisfactory
— 40°F. (Grade C)	118	...
— 20°F. (Grade C)	145	170
0°F. (Grade C)	173	203
20°F. (Grade C)	195	235
0°F. (Grade A)	170	190
30°F. (Grade A)	200	221
50°F. (Grade A)	205	230
80°F. (Grade A)	210	240
110°F. (Grade A)	230	280

Ninety per cent A.S.T.M. temperature—only affects crank-case dilution or mileage and hence causes no important damage or trouble.

Octane number—only causes loss of power or sluggishness of power development and hence is of little importance unless values of 50 or 60 are encountered.

Preformed gum (A.S.T.M.) and induction period—high gum would be the worst property of a gasoline. It sticks intake values and causes carbon deposits on the piston and cylinder walls. The time of storage is vital.

	Maximum Gum	Min. Ind. Period
If used at once	20-30 mg.	....
Used within 2 mo.	20 mg.	2 hr.
Used within 4 mo.	20 mg.	2 hr.
Used within 6 mo.	15 mg.	4 hr.
Destination unknown	12 mg.	6 hr.

The above amounts of gum will cause trouble with some vehicles.

Gummy gasoline should not be mixed with good gasoline if it is to be stored. If it is to be used at once, the making of a blend is exactly the thing to do.

Corrosion and doctor tests—sour or corrosive gasolines will very quickly cause corrosion and plugging of the feed system.

Diesel Fuel Oil (Army 2-102C).—Flash-point—a low value (95°F. on Grade C and 110°F. on Grade A) only results in smoke, stench and tendency to rough operation but is of little significance except as a fire hazard.

Pour point—cannot be lower than climatic operating temperature unless operators have facilities for warming the feed system and tank.

Viscosity—gets engine out of adjustment if ranges by 10 per cent above upper limit or 10 per cent below lower limit, but only causes rough operation, smoke and stench

B. s. & w. and carbon residue—if high values of these properties are due to sand, grit dust, pipe scale, rust, etc., the fuel cannot be used for diesel engines but it might be used as a distillate fuel oil for laundries, etc. If the fuel is clean, carbon residue up to 0.5 per cent or B. s. & w. up to 0.15 per cent would only require an early overhaul of the engine.

Corrosion test—a corrosive fuel will cause rapid plugging of screens, etc., in the feed system.

High distillation temperatures—not of much importance even up to 700°F. at 90 per cent. Only causes engine deposits and an earlier engine overhaul.

Diesel index or cetane number—only causes rough engine operation and lack of power, and an earlier engine overhaul because of high temperatures. Diesel indexes as low as 31 or cetane numbers as low as 35 should make no real trouble.

Lubricating Oils (Army 2-104B).—Viscosity, flash-point, viscosity-index, sulfur, carbon residue, color, and gravity in themselves have no significance within the limits that could be encountered with uncontaminated oils.

Pour point—oil cannot be used at climatic temperatures below the pour point unless diluted with naphtha (or crank-case dilution) or unless crank case is kept warm at all times.

Ash—values above 0.35 indicates dirt, pipe scale, etc., and should not be used unless it can be established by the saponification number that the oil contains 20-30 per cent of fatty oils.

Saponification number—a high value only indicates an oil that is blended with fatty oils, and these are not troublesome except that a little carbon is formed during long operation.

Neutralization number—values up to 0.6 for straight mineral oils or 0.9 for blended oils (saponification number is high) have not given trouble unless the high value is caused by free mineral acid or alkalie (neutral number by Method C).

Finally, the properties of regular shipments cannot be far from the specification values except perhaps in the case of gum in gasoline. Any products which exhibit properties greatly at variance with specifications indicate contamination, the presence of materials foreign to oils, sabotage, or that the material is a captured or "stray" material. Such oils obviously require special consideration and would arise by so many different circumstances that they cannot be discussed here.

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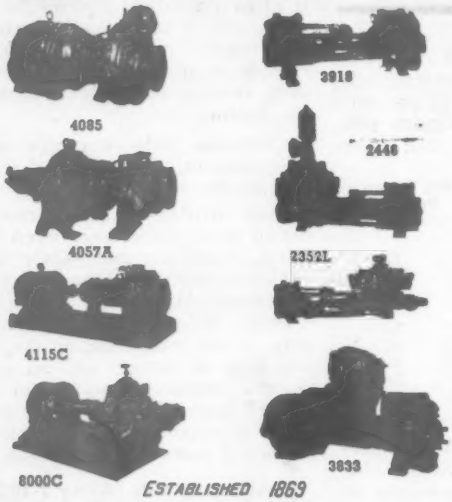

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The Refiner's Notebook

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Laboratory Corrosion Control

CONTROL or awareness of topping-plant corrosion is attained primarily by:

1. **Inspection** of equipment at time of shutdown and of metal strips (coupons or specimens) suspended at various points in the equipment. This is the real payoff as to the extent of corrosion.

2. **Salt** or **brine** reduction by means of settlers or electrical desalters. Methods of determining the salt content of crude oils and brines were discussed in the Refiners' Notebook No. 29 of February 10, 1945.

3. **Acidity** or pH value of condensate water from the gasoline condensers. Ammonia is introduced into the top of the tower. For low salt and sulfur crudes a maximum of pH of 8.5 may be used. This is on the verge of corroding red brass, but it nearly halts corrosion of other metals. With high sulfide-evolution crude oils pH values of 7.5-8 may be advisable to avoid corrosion of red brass.

4. Evolution of **hydrochloric acid** and **hydrogen sulfide** by distillations. A high-sulfur crude oil, or one that contains large amounts of salt is not necessarily highly corrosive and these methods assist in determining the actual generation of corrosive agents that will occur. They are particularly valuable in ascertaining the suitability of new crude oils. Although Petroleum Rectifying Co. of California has developed excellent methods, the procedure described here is that of Davis, Jones and Neilson (The Oil and Gas Journal, May 26, 1938).

There is altogether too much mysticism, too much profound conjecture, about the causes of corrosion in refineries. The causes of corrosion are complicated, but a careful inspection of equipment and metal coupons, a regular procedure of testing the acidity of condenser water and the salt content of settler brine, along with periodic checks on the acid and sulfide-forming tendencies of the charge stock will go a long way toward the elimination of troubles with corrosion. At least it will be quickly apparent whether or not it will be necessary to use special alloys to control the corrosion.

Evolution of HCl and H_2S by Distillation

Apparatus:

a. Long-neck 1,000-ml. flask with thermometer well.
b. Thermometer well and high-range A.S.T.M. thermometer (D 86-40).
c. Adapter neck and steam-delivery tube and source of steam.
d. 18-in. water-cooled condenser.
e. Special adapter.
f. 500-ml. Erlenmeyer receiver.
g. A.S.T.M. absorbet (D 90-41T).

Solutions:

a. Hydrochloric acid, 0.2 N.
b. Hydrochloric acid, 4.0 N.
c. Potassium hydroxide, 5% KOH.
d. Cadmium nitrate, 10% $Cd(NO_3)_2$.
e. Standard silver nitrate, 7.328 g. $AgNO_3$ per liter.
f. Standard iodine solution, .09227 N I_2.
g. B.D.H. Universal indicator.
h. Potassium-chromate indicator, 5% K_2CrO_4.

Procedure:

a. Place 50 ml. of 5 per cent potassium hydroxide in both receiver (F) and in absorber (G).
b. Deliver 500 ml. crude oil to be tested into the flask (A).
c. Heat is applied, and the temperature raised to 250°F. in 10 minutes.
d. Steam introduced into flask is so regulated that approx. 40 ml. of water condensate will form throughout the distillation.
e. Heat is applied at such a rate that 500°F. is attained in 30 minutes and 650°F. in an additional 15 minutes.
f. At 650°F. the heating and steam injection is immediately stopped.
g. Transfer solution from absorber (G) into a 40-ml. beaker, and rinse with two 15-ml. washes of distilled water.
h. Transfer contents of receiver (F) to a separatory funnel, shake thoroughly, settle, and draw the solution into the same beaker (C). Rinse the receiver and the gasoline with two 15-ml. washes of distilled water, and transfer the wash water to the beaker.
i. Carefully neutralize the solution to a pH of 6.5-7.0 with dilute nitric acid; then precipitate the sulfide and mercaptans with a small excess of cadmium-nitrate solution. Let stand 30 to 60 minutes and filter through quantitative filter paper. Wash sparingly with cold distilled water, adding the wash water to the filtrate.
j. Readjust the filtrate to a pH of 6.5, add 2 ml. of chromate indicator, and titrate with silver nitrate.

(ml. $AgNO_3$ — ml. blank) × 1.1 = lb. HCl per 1,000 bbl.

k. Cadmium sulfide and mercaptides are separated by washing the precipitate on the filter paper with a small volume of 0.2 N hydrochloric acid. The volume of acid required should be determined by experience for any given crude. The precipitate is washed repeatedly by returning the acid filtrate to the precipitate, which should be stirred while washing, to obtain complete removal of the mercaptides. Finally, sparingly wash the precipitate with distilled water, and discard the washings.
l. The precipitate of cadmium sulfide is transferred with the filter paper to a beaker; add 100 ml. distilled water; disperse the precipitate in the water by stirring. Add 20 ml. of 4 N hydrochloric acid (to make the total solution 0.6 N HCl) and titrate the liberated sulfide with standard iodine solution, using starch as an indicator.

(Total ml. I_2 — ml. blank) × 1.1 = lb. H_2S per 1,000 bbl.

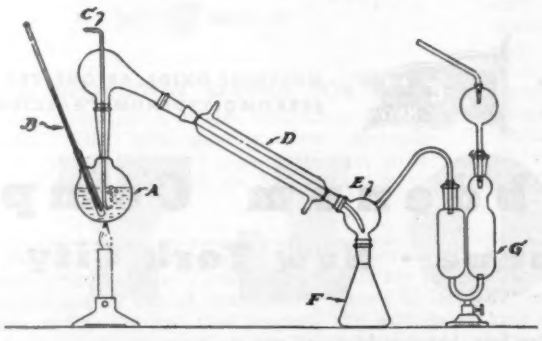

Fig. 1—Apparatus for evolving HCl or H_2S by distillation

No. 32 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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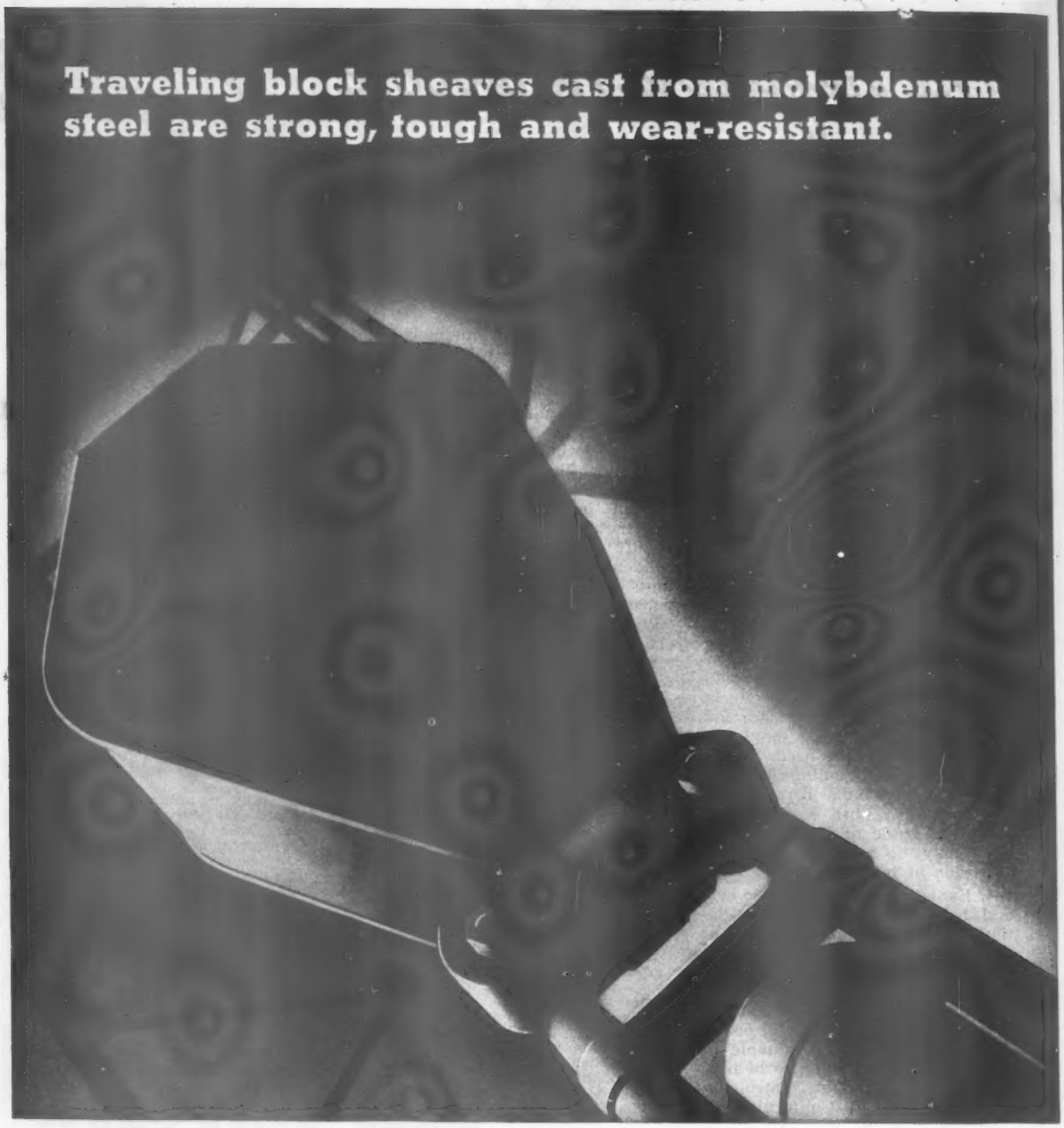

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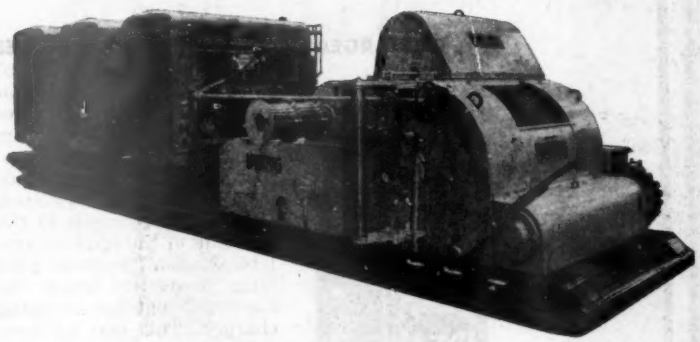
OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

by Kenneth B. Barnes

(1) U-15 ROTARY DRILLING UNIT, rated for 7,500 ft. with 4½-in. drill pipe, "from stem to stern" is built together with special features in unitized design to give a wide range in performance and control. One of the completely new



features is the hydromatic brake mounted on top of the draw-works case and driven from the drum—no extra width is added. Draw works and transmission are in the same housing. Air-O-Matic clutches, using only one moving part, are employed on the drum drive, rotary-table drive, and pump drive. The six-speed chain-type transmission, for drive to rotary or drum, is instantly handled through the patented "flexible speed controls" with one lever. Airflex clutches couple the engines to the compound. The patented cathead is an integral part of the draw works. Field tested, under full range of conditions, the drilling ability of the interlocked precision-produced mechanisms have shown the importance of the centralized controls and points of adjustments. *Unit Rig & Equipment Co., Tulsa, Okla.*

IT'S NEW CHECK IT

(2) FIELD INSPECTION SERVICE FOR DRILL PIPE, tool points, drill collars, and other drilling equipment. The new service uses specially equipped trucks to inspect pipe and other drilling equipment at the well, or on pipe rack, or in shop. The Magnaflux method of inspection is used, which heretofore has been possible only at aircraft and other industrial plants where high-voltage current was accessible.

For locating defects in metals, a high-amperage low-voltage current is applied to the part to be inspected, controlled both in amount and in direction. A powder made from para-magnetic particles is spread on the area being inspected. At points where minute fatigue cracks or other defects exist, the discontinuity of electric current causes an accumulation or build-up of the powder, hence revealing location of such defects. The procedure requires but a few minutes and results are available "on the spot." *American Inspection Service, Dallas, Tex.*

IT'S NEW CHECK IT

(3) POCKET-SIZE DIRECT-READING TACHOMETER of new type construction, weighs 5½ oz. and is 2¼ in. in diameter. For one-hand manipulation, it is equipped with both pointed spindle for application to centered shafts and elastic tip for plain-ended shafts. Direct readings are obtained without the use of either timing or a counting device. The readings show continuous operation and fluctuations. Scale runs from 500 to 3,000 r.p.m. Case is dust and moisture proofed. Made for wide, everyday use, the price of $1.50 means that every pumper can check his pumping engines, each drilling operator his drilling motors (field station engineers, etc.) without "calling town or

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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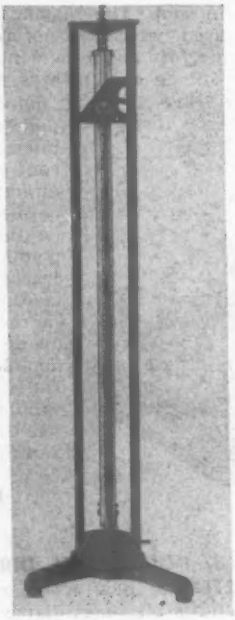
office" to come out and make a speed check. *Standard Machinery Co., Providence, R. I.*

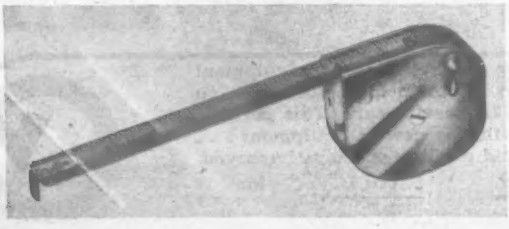
IT'S NEW CHECK IT

(4) PRECISION MERCURIAL MANOMETER has several unusual new features of interest in work involving fluid flow, metering adjustments, core analysis, etc. It can function as a manometer, barometer, differential pressure indicator, differential vacuum indicator. Full temperature compensation over any selected range of 30° C. is easily obtained by setting a graduated, knurled nut to the ambient temperature, obviating otherwise necessary corrections to scale readings. The thin edge of the movable disk gives hairline indication and readings are made to the nearest 0.1 mm. through a builtin focusing magnifier. Although standard calibration is 0 to 800 mm. of mercury, other scales such as millibars, inches of mercury, or altitude can be supplied, either in accordance with Smithsonian Meterological Table 51 or the U. S. Standard Atmosphere. *Wallace & Tiernan Products, Inc., Belleville, N. J.*



IT'S NEW CHECK IT

(5) STREAMLINE STEEL TAPE RULE is a newly redesigned product which has been precision constructed to prevent damage by bending, loosening, jamming. Not simply a ruler-gadget, it is made for standard bench and inside measurements, and for use as a height gage, caliper, and scriber. The lever lock has been reset at the back of the straight top case—which is channeled so the graduations are not marred by continued use. The case has one screw for simple take down in cleaning. Price $2, spare blades for replacement 65 cents. *Master Rule Mfg. Co., Inc., New York*



(6) DUAL-FUEL DIESEL ENGINE

is now in production which, by a single valve control, operates on either gas or oil or both together. A high-pressure fuel-gas supply is not required, as a pressure of only 2 in. of water is used. As a gas engine, pilot oil ignition is employed, eliminating electric ignition. Produced in a full range of diesel sizes, complete information and data are ready. The units retain all of the standard features of Worthington design and construction. *Worthington Pump & Machinery Co., Harrison, N. J.*

IT'S NEW CHECK IT

(7) RECHARGEABLE FLASHLIGHT BATTERIES can be kept "ready to go" in autos, trucks, etc., for quick use, by a new charger which can be installed on the dashboard or side panel just inside the door. Compact and easily mounted, the charger connects to the live side of the ignition system. A small built-in pilot lamp indicates when the flashlight battery is being charged. This can be done even though the motor is not running. The rechargeable battery fits standard two-cell 1¼-in. flashlight cases. Other charging equipment is available for charging from 110 and 220-volt sources, in single 6 and 12-gang units. *Ideal Commutator Dresser Co., Sycamore, Ill.*

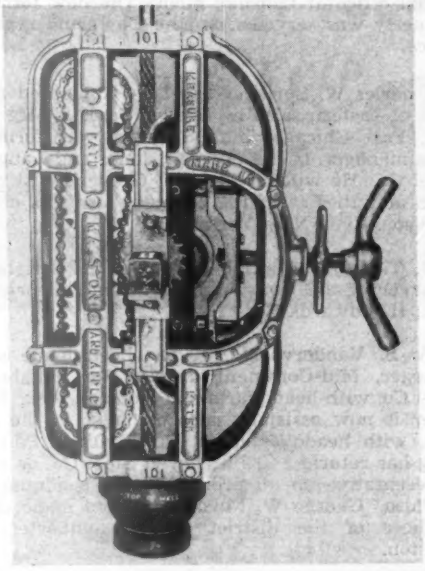
IT'S NEW CHECK IT

(8) MAGNI-RAY ILLUMINATED MAGNIFIER for map reading, preliminary core and drilling sample inspection, examination of surfaces for cracks, imperfections, and blow holes, meets the need of something better than just "a quick eye-sight look." The 5-in. lens has a wide field, and is enclosed in an aluminum housing carried on a 16-in. upright rod. The triangular 12-in. by 12-in. by 12-in. cast-iron base furnishes rigidity, has a deep green background. Two 4-in. 25-watt silvered tubular bulbs reflect light directly on the work. The instrument also has many uses in sales departments in bringing out superiority of

finish, workmanship, etc., in inspection, material receiving, drafting, machining work. *George Scherr Co., New York, N. Y.*

IT'S NEW CHECK IT

(9) MEASURE METER NO. 101 provides new arrangement of contact surfaces and counter actuation when "measuring in" with drilling or sand line. Either in drilling, setting packers, bridging,



or other operations the 101 or the companion Measuregraph and Measureel are quickly installed and easily operated. Packing assemblies are provided at both ends to wipe, clean, and oil the line. *Mason Measure Meter Corp., Tulsa, Okla.*

IT'S NEW CHECK IT

TRADE LITERATURE

(10) AUTOMATIC CENTRIFUGAL PUMPS. Well-illustrated booklet on various portable models available, specifications, etc. Listed also are such advantages as automatic priming, special sealing element, direct flow suction, nonclogging trash-type impeller and simplified adjustment. *Barnes Manufacturing Co.*

IT'S NEW CHECK IT

(11) NEW 1944 MODEL TRUCKS, 1½-ton and 2-ton capacity. Folders available describing the many new features incorporated in the civilian trucks authorized by the War Production Board. *Chrysler Corp., Dodge Division.*

IT'S NEW CHECK IT

(12) COOLING TOWERS (Atmospheric Type), New bulletin contains data for calculating cooling tower sizes, essential points in selection, and

OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

details of construction and operation of Fluor aerator cooling towers. Illustrated with photographs, section drawings and performance charts. *The Fluor Corp., Ltd.*

IT'S NEW CHECK IT

(13) INSULATION GUIDE, a well-illustrated brochure containing recommended insulation products to custom-built jobs from subzero to temperatures of 2,100° F. Illustrated, with much tabular and graphical engineering information, arranged chronologically for varying temperatures. *The Ruberoid Co.*

IT'S NEW CHECK IT

(14) CONTROLLED EXPANSION IN HEAT ENCLOSURES. A folder describing means of obtaining "controlled expansion" as a protection against infiltration and leaks in boiler walls. Such controlled expansion is desirable because the temperature varies through the refractory wall, being much less on the outside face than on the inside face exposed to the furnace heat. *Geo. P. Reintjes Co.*

IT'S NEW CHECK IT

(15) TELESCOPIC HEAT EXCHANGERS, a booklet with installation photographs, specifications, cutaway drawings and engineering data. Information on telescopic jacket water coolers, on atmospheric sections, on shell-and-tube exchangers, and on reboilers. *Western Supply Co.*

IT'S NEW CHECK IT

(16) QUALITY CONTROL is title of new 140-page case-bound handbook dealing in concise yet exhaustive manner on scientific inspection through controls offered by precision measuring instruments. The use of over 200 photographs, diagrams, charts, and tables makes the explanation of scientific inspection quite informative. Also many conversion tables and measuring data are included. Among the precision instruments and methods shown for quality control are the new mobile inspection units, sine bars, vernier gages, optical flats, comparator gages, gage blocks, and a host of other gage instruments and accessories. *Continental Machines, Inc.*

IT'S NEW CHECK IT

(17) A REPAIR GUIDE. Contains 40 pages, with 170 diagrams and simple, concise instructions on sealing cracks in castings, stopping leaks in apparatus, tightening loose fixtures. A guide for engineers, mechanics and maintenance men in the making of low-cost repairs to equipment and pipe lines without dismantling or use of heat. *Smooth-On Mfg. Co.*

INDUSTRIAL ITEMS

Employing the principle of multiple cylinders, and mounting within the cylinders double-acting pistons operated from a single crank shaft, Frank Wheatley, Sr., of Tulsa, a few years ago built a pump capable of handling large volumes of fluid at high speeds with little or no surge. United States Patent No. 2,367,452 has been granted covering the multiple-cylinder pumps as of January 16, 1945, according to an announcement by Frank Wheatley Pump & Valve Mfr. The plurality of pistons from the same crank shaft in this pump imparts a sufficient number of impulses to the fluid during each revolution of the crankshaft to practically eliminate surge. Also, cylinders are so arranged that, if desired, two different fluids can be pumped at different volumes and under different pressures. The pumps are made in three and five-cylinder models.

Johnny Best, for the past 10½ years with Mission Manufacturing Co., has resigned effective February 15 to enter the general oil-field trucking business, having helped to organize Lone Star Trucking Co., Inc., which he will serve as president and general manager. Headquarters of this company will be Houston, Tex.

Klenzoyl, sold by Klenzoyl Distributing Co., Dallas, Tex., has been used by the oil industry for the past several years in removing paraffin from wells, tank bottoms, and pipe lines. It is also claimed the product will keep paraffin from reforming for the life of the well, if a cup a day is used after it once removes initial paraffin trouble from the well. Klenzoyl is fire-proof, and contains no lye. The manufacturers say that it is a solvent—not an acid.

Houston Oil Field Material Co., Inc., of Houston, Tex., has reestablished district offices in Tulsa, with C. M. Hart as manager. Offices have been established at 1505 Philtower building. Hart has been associated with the company for 10 years and is being transferred to Tulsa from the New Iberia, La., office.

Republic National Bank of Dallas observed its 25th anniversary February 14, marking a rapid growth from a bank capitalized for $100,000 to a $235,537,264.54 institution. In 1939, the petroleum business of the bank was organized into a separate department which is headed by D. W. Forbes, vice-president; R. L. Ardry, vice-president; C. W. Austin, assistant cashier, and John R. Scott, assistant cashier.

Monsanto Chemical Co., St. Louis, Mo., will construct a new sulfuric acid plant, with an annual capacity of 72,000 tons, in the plant area of its Monsanto, Ill., properties.

MEN IN THE NEWS

The Union Chain and Manufacturing Co., Sandusky, Ohio, announces the appointment of A. C. Mohr as Chicago district manager. His office is at 53 W. Jackson Boulevard.

G. M. (Tid) Guilbert has been appointed manager of Twin Disc Clutch Co.'s newly created regional office at Lansing, Mich. The new territory formerly was served from the Cleveland regional office.

Charles W. Springer has been appointed manager of eastern sales by Graver Tank & Mfg. Co., Inc., East Chicago, Ind. Springer was formerly sales manager, barrel division, Jones and Laughlin Steel Co. He will direct all of Graver's east coast sales activities from the company's offices at 424 Madison Ave., New York City.

J. T. Cropper has been appointed warehouse manager of the Houston, Tex., branch warehouse of E. H. Edwards Co.

A. S. Vandervoort, Jr., has been made sales manager, Mid-Continent district, for Pittsburgh Steel Co. with headquarters at Houston, Tex. S. E. Elder is now assistant sales manager of the district, with headquarters at Tulsa, Okla. Paul R. King has returned to Pittsburgh Steel Co. as sales representative on all products with headquarters at Tulsa. George W. Novak has been made chief engineer of the district with headquarters at Houston.

Lip Norvell has been elected president and general manager of Norvell-Wilder Supply Co., Beaumont, Tex., succeeding E. W. Gildart. Gildart was elected a vice president. Norvell has been associated with the company for 25 years, having been manager of the company's branch at Fort Worth for a number of years. Other officers of the company reelected were Frank S. Carothers, vice-president and manager of the Houston branch, and A. H. Schultz, secretary and treasurer. Members of the board of directors are Mrs. Pansy Yount, J. H. Phelan, E. W. Gildart, M. T. Schlicher, R. E. Masterson, Norvell, Carothers and Schultz.

Gilbert H. Gaus has been appointed manager of Gardner-Denver Co.'s New York branch office at 76 Ninth Ave. He succeeds G. V. Leece, vice-president, who has been placed in charge of the company's export division.

R. L. (Bob) Gollum has left the United States on a 6-month sales trip on which he will cover all the major oil fields on the northern part of the South American continent for Security Engineering Co., Inc., Whittier, Calif.

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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Fast drilling with light weights, which is possible in nearly all formations, results in a substantial saving on rig maintenance all the way from the crown block to the bit. Where it is necessary to use heavy weights as when drilling extremely hard formations, the basic Reed cross-roller design which gives individual support to the cutters, makes for greater strength and safety.

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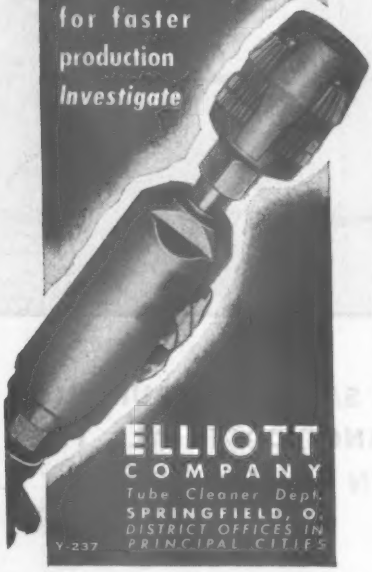

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REFINING

Five 100-Octane Refineries To Be Built, Says PAW

WASHINGTON. — Five additional 100-octane plants, costing in the aggregate some $78,000,000, are to be constructed to meet rising military needs, according to an announcement of Petroleum Administration for War. Proposals for several besides these are being discussed. All the new facilities will be built by private capital.

New plants scheduled are one for The Texas Co. at Lockport, Ill.; two for Standard Oil Co. of Indiana at Whiting, Ind., and Sugar Creek, Mo.; one for Leonard Refineries, Inc., at Alma, Mich.; one for Shell Oil Co., Inc., at Houston.

More than 60 plants now are producing 100-octane and at least 150 others are making blending agents. In 1941, production of aviation gasoline totaled only 46,000 bbl. a day. By last October it had passed 500,000 bbl.

The problem of meeting the demand for aviation gasoline has been eased in a measure by diversion of some components from the synthetic-rubber program, according to PAW, but it is understood that help from this source will continue only 6 months, instead of 2 years, as had been expected. In fact, it is indicated now that an expanded rubber program may cut into the supply of cumene, a blending agent which has accounted for 11.6 per cent of the increase in 100-octane production. A substantial supply of toluene is being denied the refining industry. It, too, is a valuable blending agent, and it is needed in the manufacture of explosives.

Cooperatives Buy Refinery Of Motor Fuels Corp.

LEVELLAND, Tex. — Consumers Cooperatives Associated, of Amarillo, has purchased the plant of Motor Fuels Corp. at Levelland, the eleventh refinery to be acquired by a cooperative wholesale organization in the United States. The plant has a rated daily capacity of 5,500 bbl. The consideration is reported to have been approximately $750,000.

The purchase includes plant and facilities, embracing modern topping and cracking units, an ethyl blending plant, desulfurization unit, 150,000 bbl. of storage, and 120 acres of real estate.

The refinery's crude supply position is described as favorable. The plant lies in Hockley County, West Texas Permian basin, and takes crude from the Slaughter pool, 14 miles southwest through a direct pipe line, which was not included in the sale.

The purchasing organization is related to Consumers Cooperative Association of Kansas City, headed by Howard Cowden, which has been a leader in acquiring and operating refineries and other petroleum properties. The Amarillo organization is headed by Leonard Cowden, a brother of Howard.

It is understood that more than 1,500 farmers, other individuals and cooperative associations purchased $440,000 in capital stock of Motor Fuels Corp. Part of the rest was financed through a loan from Houston Bank for Cooperatives and a part from the organization's own capital.

Regarding a report that cooperatives were banned from engaging in the oil business in Texas, through a ruling of the Texas attorney general, cooperative organization officials say the report is without foundation.

PAW Restricts Use of Fuel Oil in Space Heaters

WASHINGTON.—Approval of Petroleum Administration for War is new required before any kind of fuel oil may be used in commercial or industrial space heaters installed after February 26 and burning 10,000 gal. or more a year, singly or in combination. These large-scale consumers formerly could obtain fuel-oil coupons through Office of Price Administration without previous PAW approval.

Anhydrous Hydrofluoric Acid in Higher Demand

WASHINGTON. — Some 36,200 tons of anyhydrous hydrofluoric acid will be needed this year, compared with the 25,256 tons called for in 1944, representatives of the War Production Board's chemical bureau have informed the hydrofluoric acid industry committee.

The committee expressed the opinion that allocations of this chemical should be continued for the time being, but recommended that end-use restrictions be liberalized

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ECONOMY ELECTRIC LANTERN CO.
3100 W. CHERRY ST., MILWAUKEE 8, WIS.

as soon as production capacity is sufficiently expanded to satisfy military and essential civilian demands. In view of expected production expansion, the committee suggested that producers of anhydrous hydrofluoric acid be permitted to explore the postwar commercial possibilities.

Acid-grade fluorspar, produced domestically as well as imported from Mexico and Newfoundland, is in adequate supply, WPB said.

Three Steps Proposed for Energizing Lube Group

NEW YORK.—New life is expected to be injected into the lubricants committee of American Petroleum Institute through adoption of three recommendations which it is laying before the institute's executive committee for approval:

1. That the lubricants group which is now a subcommittee of the currently inactive institute marketing committee be given the status of a major committee.

2. That the committee act as a forum for discussion of technical as well as management questions.

3. That membership be increased to include a limited number of technical advisers.

It is believed these changes will not only give the lubrication committee active status but will allow it to cooperatve more fully with the institute's technical committee, and with such outside groups as National Lubricating Grease Institute, Society of Automotive Engineers and American Society of Testing Materials.

If the proposals are put into effect through W. R. Boyd, Jr., institute president, and the institute's directors, it would involve a reappointment of the committee, a spokesman for the group said. The committee now has approximately 25 members, but it has not been estimated how many additional technical members might be appointed under the proposed setup.

Fourth Star Is Added to Richmond Refinery Flag

LOS ANGELES.—Addition of a fourth star to the Army-Navy "E" flag flown by the Richmond refinery of Standard Oil of California has been announced by Adm. C. C. Bloch, retired, chairman of the Navy board for production awards. Admiral Bloch praised the "untiring efforts" of men and women employes at the refinery for increasing production. The refinery will be permitted to fly the production flag for the next 12 months.

Seized Chemical Patents Now Readily Accessible

NEW YORK.—Publication of a 388-page supplement and a 360-page master index in the seized enemy chemical patent abstracting program is announced by Alien Property Custodian James E. Markham. This was undertaken voluntarily by the Chicago section of American Chemical Society and the science-technology group of Special Libraries Association.

The complete publication provides ready access for American chemists and businessmen to some 8,000 seized United States chemical patents, most of which were issued to Germans. The master index contains more than 32,000 references and cross-references, as well as a numerical list of all abstracted chemical patents and patent applications. The supplement consists of 1,700 classified abstracts of chemical patents vested since the earlier abstracts were prepared.

A somewhat similar program is being followed with the 37,000 seized mechanical, electrical and other nonchemical patents. The material is indexed to facilitate search for significant material. Abstracts of patents on chemical machinery and apparatus are included in this publication. Two of the four volumes have just been published. The remaining two volumes are expected to be available during the next 2 months.

The complete sets of chemical and nonchemical abstracts may be purchased for $25 each from the Office of Alien Property Custodian, Chicago 3, Illinois. That office will also supply prices of separate sections or classes of these abstracts.

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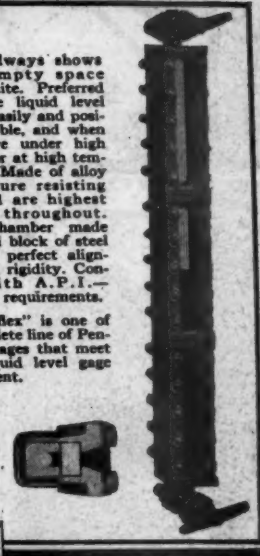

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Natural Gas

More Wells in Monroe Gas Field Authorized by PAW

HOUSTON.—Use of material required to drill, complete, equip, connect, or provide additions to any well in the Monroe gas field of Louisiana for production of gas is authorized by a directive issued by W. M. Averill, director-in-charge of District 3, Petroleum Administration for War.

The directive provides that: (1) The well must be located on a drilling unit consisting of at least 160 surface acres. (2) The well must be at least 910 ft. from every lease line, property line, unit line, or subdivision line separating unconsolidated property interests. (3) The drilling unit must not be attributed in whole or in part to any other well. (4) All separate property interests in the drilling unit must first be consolidated.

Bill Would Check Waste of Natural Gas in Kansas

TOPEKA.—The Kansas Corporation Commission's control over waste of gas in the Hugoton field would be strengthened by a bill introduced into the legislature by the senate oil and gas committee. Its sponsors said it would give the commission authority to prevent wasteful methods of manufacturing carbon black or other natural-gas products.

Gas Is Diverted Into Ohio To Alleviate Shortage

WASHINGTON. — Emergency diversion of 20,000,000 cu. ft. of natural gas daily into Ohio to alleviate the shortage resulting from the latest cold wave was ordered last week by Office of War Utilities of War Production Board. The order, telegraphed as a directive from the OWU gas division, moves additional gas to the state through pipe lines from fields in the Southwest.

Besides this, intersystem dispatching directives issued by OWU have diverted 15,000,000 cu. ft. daily to the Columbia Gas & Electric system, which serves Central Ohio, the area of most acute shortage from other systems in the Appalachian area. At the same time, OWU reinvoked the directive shutting off all use of the gas by places of amusement in eight areas.

"War plants using gas are being shut down in Pittsburgh, Cleveland, Akron, Toledo, Canton, Dayton, Columbus, Cincinnati, Wheeling, Youngstown, Buffalo and other communities in the Appalachian area," Edward Falck, OWU director, said. "It is, therefore, imperative that domestic and commercial customers drastically reduce their take so long as the cold weather lasts."

PAW Issues Restrictions On Use of Propane Gas

WASHINGTON. — Restrictions on use of propane gas, distributed in containers for heating and cooking, have been announced by Petroleum Administration for War. The action was declared to be necessitated by the growing demand for the gas in war plants.

The revised regulations forbid new orders for equipment needed in the production of "bottled" cooking or heating gas except in Arizona, California, Nevada, Oregon, Washington, Alaska, and Hawaii. They direct dealers wherever they may be situated to make application to PAW for all propane-gas installations, except for maintenance or repair.

Similar measures to conserve butane, another "bottled" gas, have been in effect since November 24, 1944.

Carbon-Black Shortage Slows Recap Improvement

WASHINGTON.—Manufacture of Grade A camelback for recapping passenger-car and small-truck tires will be postponed indefinitely by current shortages of carbon black, War Production Board has announced. The board's rubber bureau explained that the regulations have been revised so as to continue manufacture of Grade C camelback in place of the prohibited Grade A. Originally, the restriction on Grade A output was to extend only through March 31.

Grade A camelback, made entirely of buna-S synthetic rubber, requires large quantities of new carbon black. In contrast, Grade C uses approximately 30 per cent reclaimed rubber, which already contains large quantities of the scarce carbon black. Future Grade C camelback probably will contain an even larger percentage of reclaimed rubber, the rubber bureau said, because of a recent order requiring that camelback be made with 10 per cent less carbon black than heretofore.

As a further conservation measure, the armed forces will use Grade C camelback for recapping the smaller sizes of military tires.

Interim allocations for carbon black have been completed, bringing the total February allocation to approximately 78,000,000 lb., WPB reported. Allocation of carbon black for March and April were expected to approximate the quantity allocated for February.

OPA Lifts Ceiling Price of Liquefied Petroleum Gas

WASHINGTON.—An average increase of ½ cent a gallon in the ceiling prices for liquefied petroleum gas delivered by tank wagon to consumers in Oklahoma, the Texas Panhandle and 18 counties in West Texas has been authorized by Office of Price Administration, the increase becoming effective February 26.

The new ceilings in Oklahoma and the Texas Panhandle are 7 cents a gallon for single-lot deliveries of 220 gal. or less, 6½ cents for more than 500 gal. In West Texas the ceilings are 7½ cents for single-lot deliveries of 200 gal. or less, 7 cents for 221 to 500 gal. and 6 cents for more than 500 gal.

Canadian Gas Association To Meet at Murray Bay

TORONTO.—Canadian Gas Association will hold its thirty-eighth annual convention June 19-22, at Murray Bay, Quebec. Headquarters will be at the Manoir Richelieu Hotel. H. W. Durgy, division superintendent of Dominion Natural Gas Co., Ltd., is chairman of the speakers and sessions program. J. C. Dawson, superintendent of gas and coke division, Quebec Power Co., is chairman of the entertainment committee, assisted by A. J. Strain, superintendent of domestic sales, Consumers Gas Co.

Panhandle Carbon Co. to Increase Its Facilities

WASHINGTON. — Panhandle Carbon Co., Inc., New York, has been authorized by Defense Plant Corp. to increase its facilities at Eunice, N. M., at a cost of approximately $165,000. The company will operate the facilities, title remaining in DPC, whose action brings its over-all commitment to Panhandle Carbon to approximately $2,000,000.

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PIPE LINES

Tenn. G&T Co. to Add Four Compressor Stations

On the section of the Tennessee Gas & Transmission Co.'s system lying between Monroe, La., and West Virginia, the company is planning to build four additional compressor stations. These will be located near Greenville, Middleton and Springfield, Miss., and Frenchburg, Ky. The stations costing $5,000,000 will provide for delivering 60,000,000 cu. ft. daily in addition to the 200,000,000 cu. ft. daily now being transmitted. Construction is to be completed November 1, 1945. War Production Board has authorized an AA-1 priority rating for the project. Application has been made for authorization by Federal Power Commission.

United to Build 140-Mile Line

United Gas Pipe Line Co. will lay a 140-mile 24-in. line from the Carthage field of East Texas to a connection with the Tennessee Gas & Transmission Co. system near Monroe, La., which will cost $7,000,000. In granting a top priority of AA-1, War Production Board has explained that the line is necessary to assure delivery of a large volume of gas to the Tennessee system for transmission to the Appalachian area as well as to other major pipe lines from the Monroe field which serve the southeastern part of the United States. The project is to be completed November 1, 1945. An application for necessary authority has been made to Federal Power Commission.

Lone Star Starts 90-Mile Carthage-Trinidad Project

Lone Star Gas Co. has been unloading pipe for the laying of 90 miles of pipe line from the Carthage Trinity series gas and distillate pool in Panola County, to its plant at Trinidad, Henderson County, Texas. The Lone Star company has agreed also to undertake another project which will consist of providing for the delivery of gas from properties of Rogers Lacy to a location 9 miles north of Carthage, Tex., where Lacy is to install a cycling plant which has been operating at Willow Springs, Tex.

India Line to Deliver to Kunming, China, Soon

From Calcutta, India, to Kunming, China, refined products will be pumped in the early months of 1945 according to information presented to Congress by Representative Mansfield of Montana.

The 1,750-mile line was divided into two sections. One consists of 750 miles of 6-in. from Calcutta to Tinsukia where it delivers to a large storage terminal. The other is 1,000 miles with two 4-in. lines from Tinsukia to Kunming.

Although the line parallels the Stilwell (Ledo) Road as closely as possible, it was necessary to deviate at several points. At one 20-mile section at the Pangsau Pass, a tenth of the line has been supported by cable.

The pipe has been laid at altitudes over 4,000 ft. and it will cross ranges of 8,500-ft. altitude in China.

Although the work had to progress frequently under fire of Japanese assaults, there have been no reports of damage by enemy attacks.

The two 4-in. lines have a capacity for delivering 8,000 bbl. daily. A third of the system beyond Tinsukia has been in operation since December, supplying fuel for tanks, road building equipment, military vehicles and airplanes.

Plan for New Gas Line To Mexico Stirs Protest

WASHINGTON.—A brief signed by two of the three members of the Texas Railroad Commission and filed with Federal Power Commission protests against the plan of piping more natural gas to Mexico, even as a gesture of good will. The brief, signed by Chairman Olin Culberson and Commissioner Beauford Jester, opposes granting Reynosa Pipe Line Co. permission to build a line capable of moving 60,000,000 cu. ft. of gas daily from Hidalgo County fields in Texas to Monterrey, Mexico. Commissioner Ernest O. Thompson did not sign.

The brief said in effect that to permit use of the 60,000,000 cu. ft. of gas daily would be to build in-

dustries in Mexico at the expense of Texas.

"We believe firmly that the United States should in all things be just and generous to Mexico," said the brief. "On the other hand, a nation owes its first duty to its own people. Our nation will not gain respect from Mexico by undue profligacy. The United States is not required, even in proof of its friendship and good wishes to Mexico, to limit its own growth and abridge the safety and comfort of its own citizens that a neighboring country may correspondingly benefit. In already furnishing 30,000,000 cu. ft. of natural gas a day to Monterrey, Texas is doing enough for that city. In justice and fair play we cannot be called upon to furnish an additional 60,000,000 cu. ft. daily. It is our humble but patriotic belief that such would not be in the furtherance of the national welfare."

The Texas commissioners pointed out that if the application is granted the entire output will be consumed by a group of industrialists, and that "it is the declared purpose of this group to erect a great industrial city, using Texas gas for fuel and putting the gas to crude and inferior industrial uses."

Increased demand can be expected for gas in South Texas as industrial development gains, the Texas commissioners said.

Helium Pipe Line Valve Wins Award

For inventing an automatic cut-off valve to prevent pipe-line leakage of thousands of dollars' worth of helium, Carl E. Baird, a mechanical engineer of the Bureau of Mines, has won the Department of the Interior's award of excellence and $1,000 in cash, the highest cash award within the gift of the Department.

Baird, now employed at Otis, Kans., developed a device which has been installed on the 90-mile helium pipe line from Shiprock to Gallup, N. M., which operates at 2,000 p.s.i. At that pressure, far above that of ordinary gas transmission lines, most of the helium would be lost, in case of a leak, if manually-operated valves were used. With the automatic valve in operation, most of the $10,000 worth of helium in the pipe line would be saved. In addition, adoption of the valve results in annual cumulative savings of $14,000 in patrolmen's salaries and $20,000 in transportation costs for line patrol.

Baird's invention, all rights to which have been assigned to the government, is capable of wide commercial application in steam power plants, in the control of ammonia lines in refrigeration plants and other industrial enterprises using dangerous or corrosive chemicals.

Effort to Curtail Pipe Stringing Operators

The Texas Railroad Commission last week asked the Interstate Commerce Commission to deny petitions of 10 oil field motor carriers to amend their certificates to include authority for pipe-line stringing.

The railroads expressed fear that under the language of the proposed amendment, the oil field carriers might be able to change from highly specialized carriers to general carriers transporting other commodities without filing an application and proving public necessity and convenience.

They expressed the belief that the language would result in giving the oil field haulers authority to transport such less-carload and less-truckload freight as the railroads and "regular" truck lines had been hauling for the oil industry.

The petition for amending the certifications was filed by Spicers, Inc., C. L. Tyrrell, R. D. Richardson, Fred Stewart, S. H. McCright and others.

Waltham-Dracut Operations Suspended Until Spring

Work on the 25-mile 4-in. Waltham-Dracut, Mass., leg of the products line being built for Colonial Beacon Oil Co., has been suspended until spring. Laying of the 12½-mile 6-in. line from Colonial Beacon's refinery at Everett, Mass., to the Shell Oil Co., Inc. products pipeline terminal at Waltham is being pushed for completion this month.

Despite the protest of the city of Lawrence, the Massachusetts department of public works has granted a license to Colonial Beacon for construction of a pipe line under the Merrimack River in the area between Dracut and Andover.

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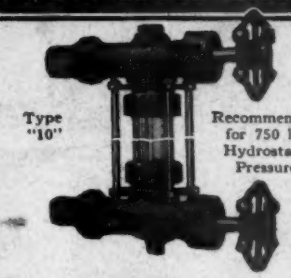

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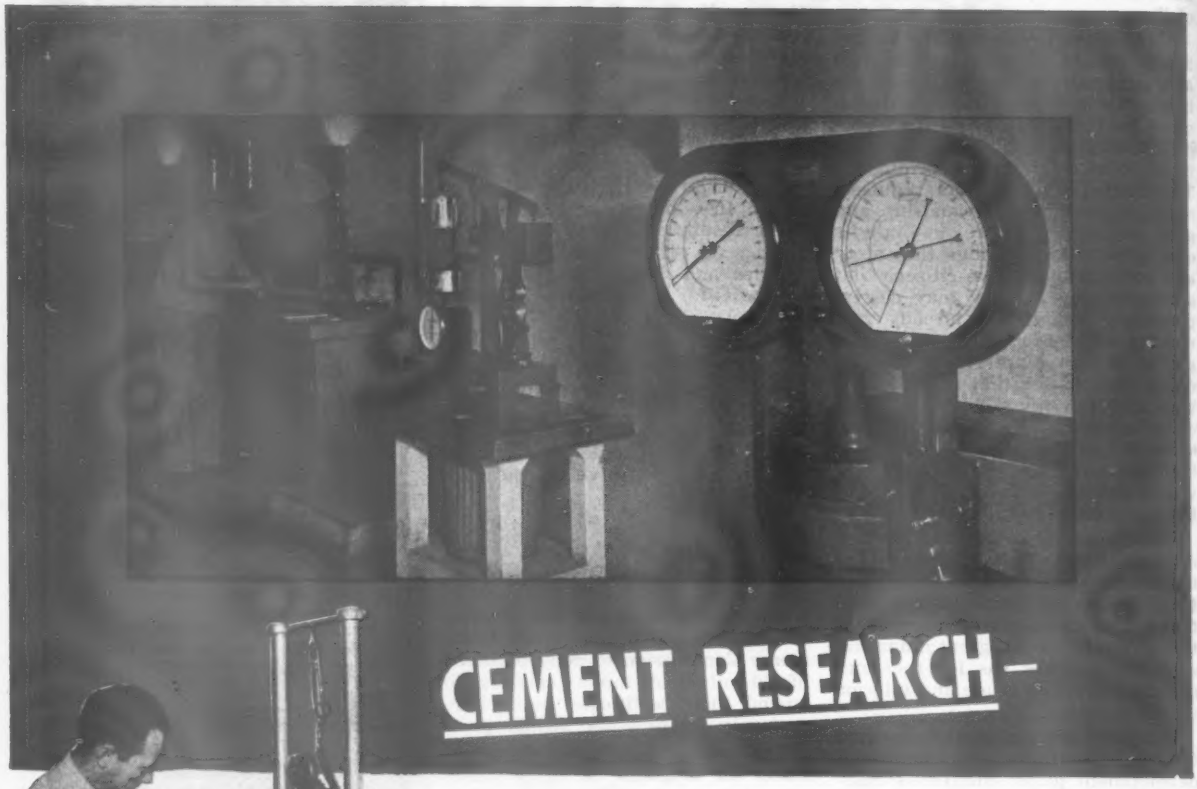

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Exploration and Drilling

Week's Highlights

THIS is the time of year when the executive geologists, and others connected with the eploration end of the oil business, do a lot of mental stocktaking.

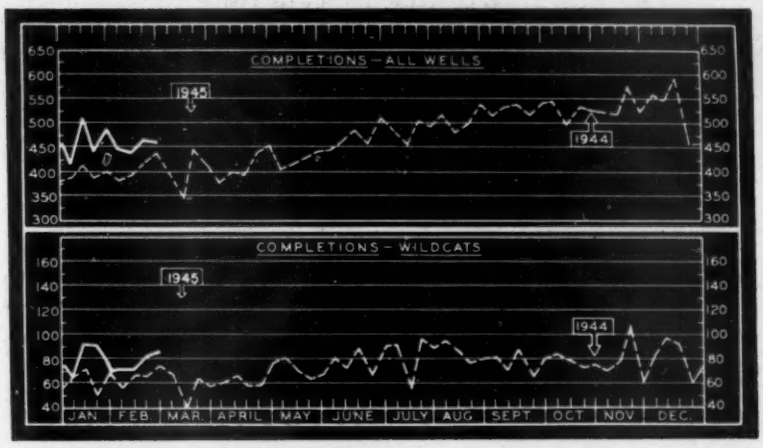
Some of the strain of the past 2 years is relieved, now that their own company reserve data, as reflected in the A.P.I. estimates of proven crude-oil reserves, have verified The Oil and Gas Journal's estimates showing that there was a small net addition to reserves in 1944, instead of a further decline. Discussions therefore tend to take a longer range point of view.

There is more discussion about basic research into the "how" and "why" of the formation and accumulation of oil. Some argue that chemical research offers great potentialities, and that some day, perhaps within 10 years, the geochemists may solve the problem of locating ail in place. Others, while agreeing that chemical research may help, insist that at best it will only help the geologist to interpret his data.

It is rather widely accepted that nothing new in geophysical instrumentation can be expected for some time after the war. Most experts maintain that instrumentation is now ahead of interpretation, and that when more manpower is available, it should be concentrated on analysis. However, hints crop up that a few organizations are working on ideas that they believe will add substantial improvements.

Some geologists maintain that existing geophysical and geological tools are more successful in finding oil fields than they are in making profits. They point to a large number of deep, very small fields that have been found in the past few years where the cost of finding and developing will probably not be paid off by the amount of oil in the field.

Finding stratigraphic traps is proving very difficult and expensive with the element of luck playing a large part. This is because the region of "probability" where such traps may be found cannot be narrowed down to a small enough area, leaving too much territory where only the drill stem can determine the facts.



Solid line charts current weekly completions, service wells in Eastern area included

COMPLETIONS IN ALL FIELDS . . .

Week ended February 24, 1945

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1945	1944
N. Y., Penna., W. Va.	36	16	*35	87	141,018	766	481
Ohio	2	6	13	21	63,394	111	137
Indiana	3	0	3	6	14,283	32	44
Kentucky	1	3	6	10	23,055	62	90
Illinois	19	0	8	27	74,196	271	253
Michigan	4	0	7	11	28,583	107	84
Kansas	10	0	13	23	75,796	210	286
Nebraska, Missouri, Iowa	0	0	2	2	1,071	8	11
Oklahoma	30	1	15	46	192,669	356	219
Texas:							
North Central	23	1	18	42	107,731	302	193
West	32	0	19	51	228,181	279	220
Panhandle	2	9	0	11	36,203	86	20
Eastern	1	1	1	3	20,622	42	49
Gulf Coast	12	4	9	25	164,257	242	74
Southwest	4	1	9	14	62,530	93	153
Total Texas	74	16	56	146	619,524	1,044	709
Louisiana:							
Northern	4	0	3	7	43,185	42	37
Southern	9	0	2	11	103,867	94	57
Total Louisiana	13	0	5	18	147,052	136	94
Arkansas	0	0	2	2	9,406	25	33
Mississippi	1	0	5	6	45,329	44	26
Southeastern States	0	0	0	0	0	3	†
Montana	4	1	2	7	20,981	45	34
Wyoming	2	0	1	3	13,634	32	15
Colorado-Utah	0	0	1	1	1,020	6	4
New Mexico	4	0	3	7	20,728	73	58
California	27	1	9	37	147,269	347	275
Total United States	230	44	186	460	1,639,008	3,678	2,833
Total previous week	258	47	161	466			
Total Feb. 26, 1944	240	38	126	404			

*Includes 30 service wells. †Included in total shown for Mississippi.

SOUTHWEST TEXAS

Duval Discovery Flows 72 Bbl. on Potential Gage

CORPUS CHRISTI.—M. M. Miller & Sons 1 George Herbarger, new discovery east of the Longhorn field, Duval County, in Block 26, Santos Flores Grant, on 24-hour potential test, flowed 72 bbl. of oil, no water, through 9/64-in. choke. Pressures were 260 lb. on tubing and 1,120 lb. on casing. Gas-oil ratio was 528 to 1, gravity 45.2°, from 19 perforations at 5,840-45½ ft. Total depth is 5,948 ft., with 7-in. casing set at 5,890 ft.

Seaboard Oil Co. of Delaware 1 Sallye Treadwell, wildcat, 2 miles southeast of Coy City, Karnes County, flowed 62 bbl. of condensate per day through ½-in. choke with gas-oil ratio 11,000 to 1. Total depth is 8,005 ft. and 5½-in. casing is set at 7,920 ft. with perforations from 7,835-40 ft.

Fred W. Shield 1 J. L. Courtney, Geo. Kerr Survey, in Block 11 of Tulsita townsite, Bee County, is testing perforations at 7,048-59 ft. Drill-stem tests at 7,030-42 ft. and 7,048-58 ft. recovered oil. Total depth is 7,504 ft., with 5½-in. casing set at 7,227 ft.

Quintana Petroleum Corp. 3-D South Texas Syndicate, deep wildcat test, 10 miles southwest of Fowlerton, McMullen County, was dry at total depth of 15,301 ft. No shows were reported.

SUCCESSFUL WILDCAT COMPLETIONS IN SOUTHWEST TEXAS

Duval County—New oil pool: M. M. Miller & Sons 1 George Herbarger, Santo Flores Grant, Agua Poquita Sur., Blk. 26, 9 mi. S of Benavides, TD 5,948 ft., perforated 19 holes 5,840-45½ ft., PT 72 bbl. daily 9/64-in. choke, gas-oil ratio 528 to 1, TP 260 lb., CP 1,120 lb., gravity 45.2°, no water.

Zavala County—New gas-distillate pool: The Texas Co. 1 National Bank of Commerce, E. A. Wolf Sur., Abst. 1,202, 9 mi. fr. S and 2 mi. fr. E lines of county; TD 4,933 ft., perf. 4,224-36 ft., PT 10,000,000 cu. ft. gas daily, open flow, and 575 gal. distillate; gas-oil ratio 102,000 to 1, TP 1,347 lb., ¼-in. choke, no water.

WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS

Bastrop County: Marts & Beaven, Inc., 1 A. P. Erhardt, J. M. Bangs Sur., 6 mi. NW of Bastrop, dry at 3,006 ft.

Brooks County: Standard of Texas 1 C. M. De Pena Lease 4, C. M. De Pena Sur. 2, 12 mi. W of Encino, dry at 7,100 ft.

Duval County: Smith & Story, Inc. 1 John T. Dinn, Sec. 252, 8½ mi. N of Bruni, dry at 3,310 ft.

Hidalgo County: Sinclair 1 Grace Callaway, Tex-Mex Railway Co., Sec. 276, Lot 6, 2 mi. W of Edinburg, dry at 8,026 ft.

Karnes County: Superior 1 Y. Y. Wilbern, C. C. Rogers Sur. 5 mi. SW of Nordheim, dry at 8,575 ft.

LaSalle County: Jess McNeil 1 fee, Sec. 16, 6 mi. N of Fowlerton, dry at 3,250 ft. (Completed as fresh water well).

McMullen County: W. C. McBride 2 Mrs. Loma Pugh et al, E. L. Garrett Sur. 93, dry at 935 ft.

Nueces County: Sun Oil Co. 1 F. D. Bancroft, Cuadrillo Irrigation Co., Sur. 138, 7½ mi. SW of Corpus Christi, dry at 9,220 ft.

Starr County: George H. Echols 1-A Starr County Cattle Co., Porc. 89, Blk. 16, Jeffries Subd., 12 mi. NE of Rio Grande City, dry at 3,050 ft.

TEXAS GULF COAST

Satsuma Field Extended West by Tide Water Well

HOUSTON.—Tide Water Associated Oil Co. 1 Ruth G. Cobb, in WCRR Survey, and a west extension to the Satsuma field, Harris County, flowed official potential of 339.11 bbl. per day on ¼-in. choke from 24 perforations at 6,822-26 ft., with pressures of 750 lb. on tubing and 1,500 lb. on casing, no water, gravity 40°, gas-oil ratio 1,125 to 1. Drilled to total depth of 7,805 ft., 5½-in. casing was set to 7,103 ft., and 2⅜-in. tubing at 6,898 ft.

Navarro Oil Co. 1 Foster Lumber Co., Wilcox discovery well in George Taylor Survey, San Jacinto County, 2 miles south of Cold Springs, is drill-stem testing new perforations at 7,906-10 ft., flowing 7½ bbl. fluid per hour of which 85 per cent is 36-gravity oil, still cleaning on 3/16-in. choke. It shows 650 lb. working pressure with gas-oil ratio of 1,000 to 1. Two previous tests, both in perforations at 7,905-10 ft. had shown too much gas.

WILDCAT FAILURES COMPLETED IN TEXAS GULF COAST

Colorado County: W. Stewart Boyle and John Mayo 1 R. S. Stephens, SA&MG Sur., 2 mi. NW of Garwood, dry at 7,014 ft.

Liberty County: Gulf Oil Corp. 1-C B. E. Quinn, South Cleveland area, James Humphries Sur., dry at 10,804 ft.

CALIFORNIA

New Pay Zone Probable In Old Montebello Pool

LOS ANGELES.—Fullerton Oil Co. recompleted one of its older wells in the Montebello field several days ago and the well indicates a possible new pay on the south flank of the structure. This was a sharpshooting job, the casing having been gun perforated at a preselected point. Estimates place the initial production in the range of 300 and 800 bbl. per day of high-gravity oil. In the Montebello extension area, Standard Oil Co. of California is preparing to test an oil sand at 9,000 ft. The sand found by Union Oil Co. several months ago was gray and wet in Standard of California's test. Sands in the extension at depth appear to be quite lenticular and this together with the fact that sands are generally gray makes correlation work difficult. Union's log shows the sand found by Standard but it failed to come up to expectations and was not produced due principally to mechanical difficulty.

The deep test that operators are watching with more than passing interest is Standard of California's well at Lost Hills in the San Joaquin Valley. This is a joint test participated in by several operators holding adjacent acreage and is in an area where deep sand production should be expected. Standard got by the high head water zone without difficulty in contrast with previous experience. A string of 16-in. casing was landed at 2,509 ft. and another string will be landed at the base of the Santos shale. This deep test is on the Cahn property, 4-27s-21e. Considerable drilling trouble is common in this region and every attempt is being made to make the present operation a conclusive test. There is some question about closure at the north end of Lost Hills.

Shell Oil Co., Inc. has started a second well in the Capitan field of Santa Barbara County and will probably carry it into the recently discovered zone which was proved up by the company's 1-35 Covarrubias in 32-5n-30w. Two productive zones were discovered in 1-35 Covarrubias and the new well now making hole will provide adequate markers for the drilling of additional holes.

Shell has reached 10,860 ft. in 48-A Alamitos, a deep test in the Long Beach field. Shell's second deep test at Long Beach, 1 Stakemiller-Rose, is progressing at 9,960 ft. Several deep tests have been drilled at Long Beach but in every case drilling operations were concluded when the Dormax zone was reached. Shell's plan is to make a thorough test of deep zone possibilities as this company has considerable acreage at Long Beach and

DAILY AVERAGE PRODUCTION FOR WEEK

	Feb. 24 crude oil	Distillate, allied products	March PAW quota all oils	Feb. 17 crude oil
Alabama	250	.....	300	250
Arkansas	82,100	5,200	85,200	82,200
California	902,450	58,810	966,160	902,150
Colorado	10,400	.....	9,500	9,850
Eastern	60,100	8,400	76,600	57,500
Illinois	205,800	12,000	210,000	204,000
Indiana	12,900	.....	12,000	12,700
Kansas	272,850	4,300	278,300	271,350
Kentucky	31,900	3,200	35,200	30,900
Louisiana	363,600	40,000	400,000	363,550
North Louisiana	68,800	.....	.....	68,750
South Louisiana	294,800	.....	.....	294,800
Michigan	44,500	700	47,700	51,050
Mississippi	51,450	.....	53,000	51,500
Montana	22,350	300	23,300	22,300
Nebraska	950	.....	1,000	900
New Mexico	103,750	4,900	109,900	103,750
Oklahoma	368,500	28,000	391,000	366,300
Texas	2,146,400	156,000	2,316,000	2,146,400
East Texas	392,000	.....	.....	392,000
East Central Texas	144,200	.....	.....	144,200
North Central Texas	148,800	.....	.....	148,800
Texas Panhandle	88,000	.....	.....	88,000
West Texas	464,300	.....	.....	464,300
Southwest Texas	347,000	.....	.....	347,000
Gulf Coast	562,100	.....	.....	562,100
Wyoming	97,000	3,600	103,600	92,350
Total United States	4,777,250	325,410	5,118,760	4,769,000
Change from previous week	up 8,250			

Total production January 1-February 24, 1945 ..... 260,237,510 bbl.
Same period last year ..... 241,697,795 bbl.

the finding of a new productive zone would greatly enhance future production.

WILDCAT FAILURES COMPLETED IN CALIFORNIA

Los Angeles County, Calabasas district: M. L. Gillespie 1 Calabasas, 22-1n-17w, bottomed in gray sand, no showings, TD 3,172 ft.

Kern County, Greeley district: Superior 12 Kern County Land, 3-30s-26e, bottomed in barren gray sand, only minor showings, TD 13,131 ft.

Santa Barbara County, Naples district: Shell 1 Dreyfus, 8-4n-29w, bottomed in gray sand, no important showings, TD 2,142 ft.

Fresno County, San Joaquin district: Seaboard and Superior 72-6 San Joaquin, 6-15s-17e, all sands were gray, Kreyenhagen 5,802 ft., Eocene 6,185 ft., Domengine 6,212 ft., Cretaceous 6,270 ft., Wheatville sand 6,409 ft., TD 6,455 ft.

N. CENTRAL TEXAS

Cores Disappointing in Cooke-Discovery Offset

WICHITA FALLS.—Sun Oil Co. 1 Butler, 2 miles north of Sivells Bend in Cooke County, is coring ahead having failed to recover shows from four cores between 6,770 ft. to 6,825 ft. It is an east offset to The Texas Co. 1 Rasure, discovery in the Strawn sand at 6,756-64 ft.

J. C. Jennings 1 I. H. Kempner, Block 17, Bosque County School Land, about 3 miles northwest of the new Bend conglomerate pool in Clay County, made a 45-minute drill-stem test from 5,920-45 ft. and recovered 30 ft. of oil-cut mud. It is drilling ahead at 6,010 ft.

Consolidated Oil Co. 1 Payne-Jones, BBB&C Survey A-35, 1 mile west of the Madden pool in southern Wichita County, made a 30-minute drill-stem test from 4,411-38 ft. and recovered 145 ft. of oil-cut mud with good show of gas. It is drilling below 4,495 ft. in shale.

Approximately ¼ mile southeast of Panhandle Producing & Refining Co. 1 Cherryhomes, new Strawn sand discovery for southeastern Jack County, the same company has staked 1-A Cherryhomes 467 ft. from the north and west lines of 427-acre tract in the T. Burbridge Survey A-68.

Mid-Continent Petroleum Corp. has staked 1 S. B. Burnett, a 6,500-ft. test southwest of the Ross Strawn sand pool, King County, which was opened by the Ohio Oil Co. 1 Ross. The new test is 987 ft. from the east line and 950 ft. from the south line of the G. W. Lampson Survey A-247, 16 miles east of Guthrie.

A 7,200-ft. wildcat for southeastern Clay County, approximately 2 miles southeast of the Wynn Mississippi lime area, is the Continental Oil Co. 1 W. M. Hillin. It is 1,400 ft. from the west line of Block 3,290, TE&L Survey, 4 miles southwest of Bellevue.

SUCCESSFUL WILDCATS AND EXTENSIONS IN NORTH CENTRAL TEXAS

Archer County: D. H. Bolin 1-B W. C. Thomas, Lot 14, Nathan Thomas Sur. A-454, 2 mi. W Archer City, elev. 986 ft., pumped 10 bbl. day, TD 1,163 ft.

Clay County: Extension—Lewis Breeden 1 Pat Berry, Sec. 2626, TE&L Sur. A-485, 3 mi. N and 1 mi. W Antelope, elev. 1,060 ft., top pay 3,153 ft., pumped 248 bbl. day, TD 3,172 ft.

Throckmorton County: James Stewart & Co. 1 J. W. Tharp, Sec. 3007, TE&L Sur. A-729, 7 mi. NE Throckmorton, elev. 1,295 ft., top pay 4,260 ft., perf. 4,260-70 ft., Caddo, pumped 171 bbl. day, Mississippian 4,822 ft., TD 4,885 ft.

Wichita County: R. H. King et al 1 T. B. Mitchie, L. Neatherly Sur. A-240, 6 mi. E Kemp City, elev. 1,024 ft., top pay 3,930 ft pumped 70 bbl. day, CP 400 lb., gravity 43.2, TD 3,990 ft.

Young County: Maguire Ind., Inc., 1 M. Berndardt, Sec. 1474, TE&L Sur. A-900, 3 mi. N Jean, flowed 168 bbl. day, top pay 4,392 ft. Caddo, TP 180 lb., gravity 44.8°, TD 4,489 ft.

Maguire Ind., Inc. 1-B B. W. King, Sec. 455, TE&L Sur., top pay 4,779 ft., flowed 331 bbl. day through 1-in. choke on 2-in. tubing, gravity 44.2°, TD 4,795 ft.

WILDCAT FAILURES COMPLETED IN NORTH CENTRAL TEXAS

Archer County: D. H. Bolin 1-A J. A. Young, Sec. 2486, TE&L Sur., 3½ mi. N Megargel, dry, TD 1,535 ft.

James L. Nelson 1 First State Bank, Blk. 5, Lot 33, Clark & Plumb Sur., 1 mi. S and 4 mi. W Scotland, elev. 979 ft., dry, TD 1,203 ft.

Panhandle (S. D. Johnson) 1 Dr. A. B. Edwards, Lot 37, Lule P. Hunt subd., Madison CSL Sur., 2½ mi. NW Scotland, elev. 993 ft., Caddo 5,347 ft., dry, TD 5,426 ft.

Cooke County: Allied Pipeline 1 R. E. Soloman, J. Musick Sur. A-780, ½ mi. NW Valley View, dry, TD 1,688 ft.

High Point Oil 1 W. W. Otto, MEP&P Sur. A-766, 4 mi. S and 2 mi. E Muenster, dry, TD 2,026 ft.

Throckmorton County: L. R. Scott et al 1 G. W. Carpenter, Sec. 944, TE&L Sur., 7 mi. S and 4 mi. W Throckmorton, dry, TD 1,451 ft.

Young County: Calapor Mfg. Co. 1 S. R. Jeffery, Sec. 3408, TEL&L Sur. A-1228, 5 mi. N and 2 mi. E Graham, Chappell 4,795 ft., Ellenburger 4,940 ft., dry, TD 4,993 ft.

James Stewart & Co., Inc. 1 L. D. Reger, J. Bradley Sur. A-1371, 6 mi. S Murray, Marble Falls 4,250 ft., dry, TD 4,700 ft.

WILDCAT FAILURES COMPLETED IN WEST CENTRAL TEXAS

Coleman County: Anzac Oil 1 Mrs. Lucy Williams et al, Sec. 27, Blk. 1, GH&H Sur., 3 mi. SW Valvera, elev. 1,979 ft., Ellenburger 3,671 ft., dry, TD 3,780 ft.

Hamilton County: Sonac-Texas Oil & Gas 1 McCallum, W. R. Newton Sur., Ellenburger 3,618 ft., dry, TD 3,846 ft.

Shackelford County: O. P. Leonard 1 W. H. Green, Sec. 65, Blk. 12, T&P Sur., 12 mi. SW Albany, elev. 1,873 ft., TD 1,603 ft.

Stephens County: Consolidated & Premier Oil 1 Mrs. Clemmie Correll, G. Newton Sur. A-128, 6 mi. NE Ivan, Caddo 3,560 ft., Marble Falls 4,231 ft., dry, TD 4,760 ft.

MICHIGAN

Increased Drilling Program Indicated

SAGINAW.—Michigan operators last week obtained 23 drilling permits, largest number in months. Last week's operations included completion of another Deep River-Arenac County well for 200 bbl. an hour and one gaging 80 bbl. an hour in the Coldwater field, Isabella County. Completions totaled 11, five being producers. Two of the seven dry holes were wildcats.

Much of the new drilling is scheduled for Arenac County in which Deep River Township operators obtained five of the new permits. Other permits are for three

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locations each in Allegan, Isabella and Osceola, one each in Saginaw, Ottawa, Oceana, Missaukee, Mecosta, Lake, Van Buren and Newaygo.

Another moderate decline in crude production was shown for January in Michigan Oil & Gas Association which estimated the month's total output at 1,435,000 bbl. from 3,441 producing wells, a daily average of 46,236 bbl., slightly below the PAW quota set for March.

WILDCAT FAILURES COMPLETED IN MICHIGAN

Isabella County, Rolland Township: Leslie T. Barber 1 Parker, C N½ SE NE 26-13n-6w, dry, TD 1,325 ft.

Van Buren County, Decatur Township: Gordon Oil Co. 1 Oscar and June Luth, NW NW SW 4-4s-14w, dry in Traverse limestone, TD 1,021 ft.

SOUTH LOUISIANA

New Pay Discovered at North Jeanerette

NEW ORLEANS.—Atlantic Refining Co. 1 Teche Sugar Co., 19-13s-9e, opens a new sand for the North Jeanerette field of St. Mary Parish. Total depth is 12,992 ft. with 5½-in. casing set at 12,377 ft. After running several tests, pipe was reperforated at 11,880-92 ft. for completion and the well flowed 76 bbl. a day through 3/16-in. choke of 50.5-gravity condensate, gas-oil ratio 12,767 to 1, tubing pressure 2,100 lb.

Barnsdall Oil Co. is completing 3 Fusilier, 38-7s-3w, as a gas well to open a new sand at West Tepetate in Jefferson Davis Parish. Total depth is 9,312 ft. with 7-in. casing set on bottom. After squeezing at 9,264-68 ft. and 9,280-83 ft., pipe was perforated with 13 shots from 9,272-76 ft. On drill-stem test the well flowed at the rate of 3,170,000 cu. ft. of gas daily on ¼-in. choke with 3,700 lb. flowing pressure.

Possible new Wilcox production for the state is indicated at Louisiana Land & Exploration Co. 2-A J. A. Bentley, Jr., wildcat, in 26-5n-5w, Rapides Parish. Drilled to total depth of 7,220 ft., 5½-in. casing was set around 6,600 ft. for testing. Pipe was perforated at 6,495-6,505 ft. and on drill-stem test, using ¼-in. chokes, it flowed the water cushion and then produced at the rate of 200 bbl. of fluid per day of which 75 per cent was 38-gravity oil and 25 per cent salt water. Perforations will be squeezed to reperforate for a new test in this same sand.

WILDCAT FAILURE COMPLETED IN SOUTH LOUISIANA

Cameron Parish: Yegua Corp. 1 A. P. Dobbertine, Johnson Bayou, 9-15s-14w, junked at 8,237 ft.

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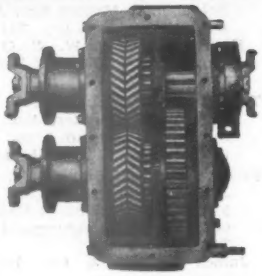

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KANSAS

Rush County Strike Named Ryan Pool

THE new Rush County pool opened by Inland Oil Co. 1 Peterson, SE SE SW 35-19-16w, with a 100-bbl.-per-hour flow, has been named the Ryan pool. Bird-Handley et al have staked a location for 1 Dirks, NW NW NE 2-20-16w, a southeast offset to the discovery. Otherwise there was a lull this week in wildcat activities.

Barber County.—Stanolind Oil & Gas Co. 1 Chain, SE SE NE 7-31-11w, 2 miles north of the Whelan pool, is drilling below 4,172 ft., after being held up for several days by a fishing job. Lansing was topped at 3,788 ft.

Barbara Oil & Gas Co. 1 Hargis, SE SE NE 7-31-14w, offset to the discovery well of the Skinner Northwest pool, has been abandoned. Lansing was topped at 3,762 ft., Mississippi at 4,318 ft., Maquoketa at 4,392 ft., Viola at 4,458 ft., Simpson sand at 4,522 ft., and Arbuckle at 4,647 ft.

Finney County.—Sinclair Prairie Oil Co. ran 1,950 ft. of 7-in. casing in attempting to stop caving at its 1 Ely, NW NW SE 30-21-28w, 30 miles southwest of the Aldrich pool of Ness County. Present total depth is 4,866 ft., and several porous zones were found in Mississippian lime at 4,720-50 ft.

McPherson County.—E. K. Carey et al 1 Leffler, NW NW NW 24-19-1w, northeast of Canton, is testing chat at 2,942 ft., total depth 2,964 ft.

Pratt County.—Kingwood Oil Co. 1 Gilchrist, CEL NE NE 7-28-11w, 2 miles north of the Cairo gas pool, is drilling below 4,371 ft. The Viola was cut at 4,266 ft. This test logged several shows in the Lansing, topped at 3,579 ft., but a drill-stem test with packer set at 3,763 ft., recovered only mud.

Sumner County.—El Dorado Refining Co. 1 Patterson, SE SE NE 23-33-2e, prospective pool opener 2 miles west of production, had Bartlesville sand at 3,269 ft., drilled to 3,276 ft., and set pipe at 3,263 ft. to test 5 ft. of good saturation.

WILDCAT FAILURES COMPLETED IN KANSAS

Barton County: Carter 1 Bates, NE SW NE 23-18-13w, elev. 1,804 ft., dry, TD 3,355 ft., Brown Kansas City 3,070 ft., White Kansas City 3,085 ft., Arbuckle 3,322 ft.

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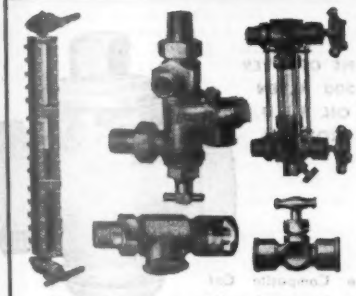

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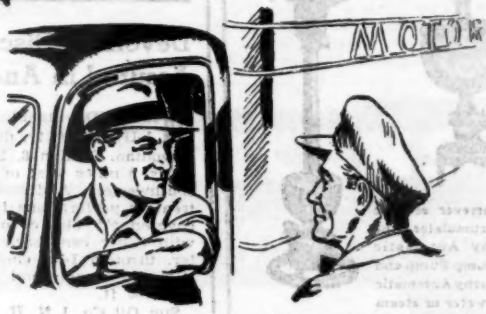

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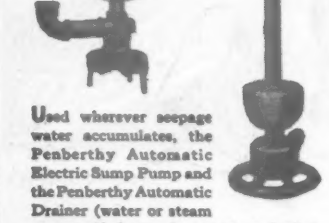

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Cowley County: Continental 1 Speer, NW SE NW 31-33-6e, elev. 1,276 ft., dry, TD 3,453 ft., Arbuckle 3,532 ft.

Graham County: Iron Drilling Co. 1 Everest, SE SE NE 32-8-21w, elev. 2,203 ft., dry, TD 3,759 ft., Kansas City 3,406 ft., Marmaton 3,622 ft., conglomerate 3,680 ft., Arbuckle 3,746 ft.

WILDCAT FAILURE COMPLETED IN MISSOURI

Cass County: Wilson et al 1 Kincaid, SW SE SE 8-45n-33w, elev. 944 ft., dry, TD 770 ft.

PERMIAN BASIN

Devonian Discovery Assured in Andrews

MIDLAND.—Stanolind Oil & Gas Co. 1-D University, discovery well in the Devonian, Section 8, Block 11, University lands, 5 miles west of the Embar field in southwestern Andrews County, after retreating perforations from 8,300-50 ft., recovered 575 bbl. of oil in 24 hours, cut with 8 per cent basic sediment and water, through 1-in. choke on 2-in. tubing. It is still flowing and testing. Total depth is 10,466 ft.

Sun Oil Co. 1 N. H. Martin, Section 17, Block A-41, PSL, wildcat approximately 1½ miles north of the Embar field, showed 30 ft. of clean 32-gravity oil on a 60-minute drill-stem test from 6,787-6,962 ft. Nine feet of dense, crystalline gray to brown dolomote showing cavernous porosity and bleeding oil was recovered by coring from 6,962-73 ft. It is drilling below 7,007 ft. in lime.

Magnolia Petroleum Co. 1 Joseph Martin, wildcat 5 miles south of Mid-Continent Petroleum Corp. 1-7 University, Siluro-Devonian discovery in northwestern Andrews, is drilling below 8,883 ft. in lime and chert. Magnolia 1-A Ralph, 1 mile west of the Fullerton pool, is drilling below 10,498 ft. in lime and shale.

Gaines County.—Sinclair Prairie Oil Co. 1 W. L. Johnson, Section 16, Block A-28, PSL, wildcat in southwestern Gaines, in samples from 6,876-6,900 ft. showed odor and stain of oil. It is drilling ahead at 7,011 ft. Humble Oil & Refining Co. 1 Shell-fee, 1 mile east extension to the Eubank pool in southern Gaines, is testing through perforations in 5½-in. casing from 7,065-7,105 ft. after averaging 6 bbl. of oil per hour on an 8-hour swabbing test.

Pecos County.—Phillips Petroleum Co. 1 Ada C. Price, deep wildcat in southeastern Pecos County, for a short time the world's deepest test at 15,279 ft., is considered dry after tests, the last reported between 11,450-550 ft. showing only slight amount of gas.

Winkler County.—Sun 2 Keystone, 2 miles northwest of Keystone-Ellenburger pool, swabbed down to 8,500 ft. from surface and recovered about 1 bbl. fluid per hour showing 20 per cent oil, 40 per cent acid and 40 per cent basic sediment. Testing will continue.

Ector County.—Magnolia 1-A Slator, west outpost to the Goldsmith field, recovered 2 ft. of hard dense dolomite bleeding oil from a core from 4,295-4,307 ft. Another attempt will be made to drill-stem test to 4,307 ft.

WILDCAT FAILURES COMPLETED IN WEST TEXAS

Andrews County: Frontier Fuel Oil 1-A University, Sec. 35, Blk. 13, Univ. lands, 9 mi. NW Andrews, elev. 3,256 ft., Tubb 6,785 ft., Wichita 6,910 ft., dry in Pennsylvania, TD 7,600 ft.

Crane County: Gulf 1-A-E W. D. Harris, Sec. 7, Blk. 6, H&TC Sur., 8 mi. NW Crossett pool, elev. 2,329 ft., Ellenburger 5,272 ft., dry, TD 5,282 ft.

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Crockett County: Moore Exploration 1-66 Halff Est., Sec. 66, Blk. 1 H&GN Sur., elev. 2,178 ft., dry, TD 1,508 ft.

Ector County: Texaco & Phillips 1 J. F. Cosden, Sec. 7, Blk. 44, T&P Sur., 3½ mi. N Goldsmith pool, elev. 3,226 ft., Ellenburger 8,700 ft., dry, TD 8,700 ft.

Gaines County: J. F. Smith 1-A Ruth McGill Dodge, Sec. 38, Blk. H, D&WR Sur., elev. 3,175 ft., dry, TD 150 ft.

Howard County: John I. Moore 1 Cosden, Sec. 38, Blk. 32, T-1-N, T&P Sur., elev. 2,483 ft., dry, TD 5,503 ft.

Kent County: Blackwell Oil & Gas 1 A. A. House, Sec. 8, Blk. B, PSL Sur., 18 mi. NW Clairmont, elev. 2,316 ft., Pennsylvanian 5,840 ft., dry, TD 7,775 ft.

Union Oil of Calif. 1 E. E. Wallace, Sec. 97, Blk. G, W&NW Sur., 12 mi. W Clairmont, dry, TD 449 ft.

Lynn County: D. D. Feldman 1 C. O. Edwards, Sec. 312, Blk. 3, ELRR Sur., elev. 3,174, San Andres 4,040 ft., dry, TD 6,982 ft.

Menard County: Phillips 1 Walter Martin, Sec. 501, J. W. Bradford Sur., 3 mi. SW Menard, elev. 2,035 ft., dry, TD 3,939 ft.

Culberson County: Robert R. Richter 1 M. A. Grisham, Sec. 36, Blk. 59, T&P Sur., elev. 3,390 ft., Delaware 3,283 ft., dry, TD 5,504 ft.

Pecos County: Phillips Pet. Corp. 1 Ada C. Price, C SW NW Sec. 11, Blk. 101, TCRR Sur., 25 mi. SE Fort Stockton, Simpson 13,100 ft., Ellenburger 15,075 ft., dry, TD 15,279 ft.

Runnels County: Hunter & Hunter 1 J. T. Brandon, Sec. 124, S. J. Lewis Sur., 2 mi. SE Crews, elev. 1,936 ft., Palo Pinto 3,140 ft., dry, TD 4,080 ft.

TEXAS PANHANDLE

AMARILLO.—Humble Oil & Refining Co. 1 J. W. Hyslop, wildcat 35 miles from Hereford in southwestern Deaf Smith County, cemented 7-in. casing at 6,744 ft. and plugged back to 6,658 ft. Casing was perforated from 6,584-6,505 ft., 2-in. tubing with packer was set at 6,464 ft. and it recovered drilling mud and water and then swabbed dry. Preparations are being made to acidize. Total depth is 7,805 ft. in granite. Humble 1 Pronger Bros., wildcat in Sherman County, is dry at 5,346 ft. in lime with no shows of oil or gas.

SOUTHEASTERN NEW MEXICO

HOBBS.—Gulf Oil Corp. 1 State-Andrews, 32-22s-38e, 1½ miles southeast of 1 Vivian Drinkard, southeastern Lea County, on an 1-hour drill-stem test from 6,713-6,888 ft. showed sweet gas to the surface in 2 minutes, estimated 6,500,000 cu. ft. of gas with spray of oil, and showed 30 ft. of free oil on breakdown of pipe. On another drill-stem test from 6,890-95 ft., with tool open 30 minutes, gas hit the surface in 4 minutes, oil in 16 minutes with estimated 10 bbl. of oil per hour and 3,750,000 cu. ft. of gas. Preparations are being made for drill-stem test from 6,888 ft. Total depth is 6,995 ft. The formations in 1 State-Andrews are running lower than those of 1 Vivian Drinkard, which was completed with initial production of 462 bbl. of oil in 24 hours from perforations from 6,375-6,460 ft.

Skelly Oil Co. 2 E. L. Steeler, 17-23s-37e, 6 miles from 1 Vivian Drinkard, recovered 30 ft. of gas-cut mud but no oil on drill-stem test at 6,320 ft. It is continuing test. In the same vicinity, Gulf 1 Paddock, 1-22s-37e, is drilling below 3,840 ft in lime.

WILDCAT FAILURES COMPLETED IN SOUTHEASTERN NEW MEXICO

Lea County: Cade & Harrell 1 B. F. Pier, 11-20s-32e, elev. 3,459 ft., dry, TD 2,927 ft.

Stanolind 1-O State, C NE SE 21-18s-34e, elev. 4,032 ft., Queen 4,510 ft., dry, TD 5,612 ft.

Eddy County: Crabb & Couch 1 Cowan, 1-21s-28e, 3 mi. NE Fenton pool, dry, TP 150 ft.

APPALACHIAN FIELD

Lower Devonian Test Fails in West Virginia

PITTSBURGH.—In Scott district, Boone County, West Virginia, the lower Devonian test of Owens Libby Owens Gas Department 43 Allen and Pryor drilled through the Oriskany sand which was dry. With elevation of 1,060 ft., the Big lime was logged at 1,330-1,510 ft., Berea 2,014-2,023 ft., Corniferous lime 4,382-4,438 ft., and Oriskany at 4,438-43 ft. At 4,435 ft. there was a slight increase in the Devonian gas. It is now drilling in lime at 4,514 ft.

In Crook district, Boone County, United Producing Co. bottomed the Oriskany wildcat, 1,182 Donald D. Shepard, at 5,695 ft. and is plugging it as dry. Surface elevation was 1,072 ft., Big lime 2,125 ft., Oriskany 5,528-65 ft.

In Tridelphia district, Logan County, United Producing Co. 1,169 Pardee Land Co. was drilled through the Devonian shales to 4,900 ft. without finding gas. It is being plugged back to the Weir for test.

In Union district, Barbour County, Hanley and Bird extended development with a Riley sand completion on the Hoffman and Trimble lease. It gages 321,000 cu. ft. of gas from the Riley sand which is just above the Benson sand, to which several fair gas wells have been completed recently in the Elk district. In Elk district, Hope Natural Gas Co. completed 8,948 N. C. Hardin as a small Riley sand well with open flow of 31,000 cu. ft.

In Union district, Wood County, the Oriskany wildcat of South Penn Natural

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Gas Co. on R. P. Ingram farm resumed drilling after casing through Corniferous lime, topped at 5,014 ft. The Oriskany should be reached within the week.

EASTERN TEXAS

Pickton Pool Extended by Well Flowing 460 Bbl.

DALLAS.—Humble Oil & Refining Co. 1 W. A. Nichols, Lazarin Survey, northeast extension to the Pickton Bacon lime pool of southern Hopkins County, on a 24-hour Railroad Commission potential gage flowed 460 bbl. of 42-gravity oil through ¼-in. choke through perforations from 7,896-7,905 ft. Total depth is 7,940 ft.

The Texas Co. 1 W. A. L. McKnight, I. H. Reed Survey, Freestone County, recovered an estimated 3,000,000 cu. ft. of gas per day showing 34 bbl. 60-gravity distillate per million, with shut-in pressure of 3,000 lb. through perforations from 8,232-47 ft. Total depth is 8,901 ft. Potential is being taken.

Preparttions are being made by Bobby Manziel of Tyler to test the Pettit lime section in his 1 Morrison, July 1944 wildcat failure in northern Smith County. Pettit was topped at 7,907 ft. and Travis Peak at 8,074 ft. Electrical log showed good porosity in the Pettit from 7,915-36 ft., good porosity with slight oil stains from 7,939-54 ft., 7,959-81 ft. and 8,038-55 ft. Total depth is 8,109 ft. It is possible that the wildcat will be drilled deeper as only 35 ft. of the Travis Peak section was penetrated.

Texas 1 G. M. Morse, 1 mile south of Chandler, Henderson County, is coring below 10,370 ft. in hard shale with no further shows reported.

Delta Drilling Co. 1 Moseley, Mitchell Survey, is a failure for the Oak Grove area of Wood County at 6,015 ft.

Gulf Oil Corp. 1 Frizzell, David Cherry Survey, Henderson County, is coring below 11,494 ft. unchanged.

Mudge Oil Co. has staked 1 W. A. Hewitt, a 5,800-ft. Paluxy test, 330 ft. from the north line and 660 ft. from the east line of a 72-acre tract in Wm. Carlton Survey, about 5 miles east of Big Sandy in Upshur County.

WILDCAT FAILURE COMPLETED IN EASTERN TEXAS

Shelby County: H&A Corp., C. A. Hayden, D. T. F. Yordt Sur., elev. 328 ft., Pettit 6,155 ft., dry, TD 7,020 ft.

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ROCKY MOUNTAIN

Baggs Anticline Attracts Extensive Wildcat Play

DENVER.—The Baggs anticline, which runs east and west in southwestern Wyoming, just north of the Colorado line, and closely related geologically to the Powder Wash oil and gas field on the Colorado side, is to have an important wildcat play. The district also is called Cherokee Ridge on some of the maps. S. Marvin James, who drilled the discovery well on the Baggs dome, has turned to The Texas Co. a block of leases surrounding this well, the unit, comprising 4,300 acres, has been approved, and the operator is preparing to drill a deep test. The location is on the Beulah H. James government lease in the NW SE SE 35-13n-92w. It will be an offset to the discovery which was drilled to 3,765 ft., in 1937, and had an estimated flow of 20,000,000 cu. ft. of gas at 2,160 ft. Drilling was in the Wasatch formation of Tertiary age. The formations checked closely with the log of the 2 Stewart well on Powder Wash which was completed recently at 5,576 ft., showing oil and gas in five separate sands, one of which at 4,190-4,230 ft. tested 1,505 bbl. of 48 gravity oil. James also turned to the Cities Service Oil Co. 5,600 acres in a block 10 miles west of the Baggs test and another block lying midway between to the Kerlyn Oil Co. The lease play extends on westward to the Hiawatha oil and gas field, and also to a parallel high which runs east and west on the Colorado side.

Gage well estimated at 25 bbl.—Northern Ordnance, Inc., 2-B Morris C NW SE 13-9n-26e, Gage Dome, Musselshell County, Montana, which reached the pay last July at 6,132 ft., is listed as a completion, but no official gage is available. It is estimated at 25 bbl. per day after a shot with 170 qt. Last year the company was credited with the completion of nine wells of which four were producers and five were dry, total footage drilled being 54,742 ft. At the end of 1944 there were five producing or producible wells in the field, exluding wells suspended in previous years now regarded as abandoned, five drilling wells, two wells shut down and four approved locations. Estimated producing potential on January 1, 1945, was 700 bbl. daily.

WILDCAT FAILURES COMPLETED IN COLORADO

Lyons, Boulder County: D. J. Bosworth No. 1, NW NE 22-3n-70w, TD 1,020 ft., dry in the Muddy sand.

WILDCAT FAILURES COMPLETED IN WYOMING

Hat Creek, Niobrara County: National As-

sociated 1 Whitmore, SE SE 34-35n-63w, TD 2,702 ft., dry, tested all horizons through the Bell (Madison) sand.

ILLINOIS

White County Outpost May Extend Trumbull Pool

CENTRALIA.—H. H. Weinert 1 Howard Kisner, SW NE SE 31-5s-9e, in White County, a wildcat, was the most interesting operation in Illinois in the week in review, as three oil pay zones were being tested. Drill-stem tests in lower Levias lime at 3,098-3,104 ft., Rosiclare lime at 3,120-32 ft. and McClosky lime at 3,140 to 3,178 ft., at intervals, developed oil and gas showings. From 3,163 to 3,180 ft. salt water was encountered. The test is 2 miles from production in the Trumbull pool.

In the East Divide pool, Jefferson County, Texas Co. 2 McKinney, SW NE NW 23-1s-3e, pumped 432 bbl. in 24 hours from lower Levias lime at 2,682-88 ft. and McClosky lime at 2,748-2,824 ft., at intervals, total depth 2,837 ft.

In the Wayne County end of the Bennington pool Aetna Oil Co. 1 Fritchley, SE NE NE 13-1n-9e, pumped 408 bbl. of fluid, 40 per cent sediment and water, from acidized McClosky lime at 3,223-64 ft., at intervals.

Two old wells deepened gave their owners an increase in production. C. E. Skiles 2 Dunkel-A, SW NW SE 5-1s-12w, in the Mount Carmel pool, Wabash County, an old Cypress sand well, was deepened from 2,305 ft. to 2,355 ft. McClosky lime at 2,335-41 ft. acidized, yielded an initial of 175 bbl. per day on the pump. Magnolia Petroleum Co. 2 Eubanks, SW SE SE 35-2s-1e, in the North Roaches pool, Jefferson County, deepened from Benoist sand to Aux Vases sand at 2,015-24 ft., total depth, pumped 150 bbl. of oil and 105 bbl. of water in 24 hours.

Twenty-seven new operations were started during the week, including the following wildcats: E. J. Ruwalt 1 J. Sherman, NE SW SE 6-3s-1e, Jefferson County; Schuler & Witt et al 1 Stalcup, NE NE SW 18-5s-3e, Franklin County; H. H. Simms 1 Murvin, SE SE SE 11-5n-7e, Clay County; Pure Oil Co. 1 Secrist, NE NE NW 21-1n-8e, Wayne County; E. E. Beatty and Lavender, in SE SE NW 35-3s-8e, Hamilton County; Ashland Oil & Refining Co. 1 Zola Stepard, NW SE NW 5-4s-10e, White County.

SUCCESSFUL WILDCAT COMPLETIONS IN ILLINOIS

Wayne County: Pure 1 S. J. Staley-A, SE SE NW 23-2n-7e, pumped 249 bbl. per day from Rosiclare and McClosky pays. Rosiclare 2,992-04 ft., McClosky at 3,007-12 ft. and 3,014-19 ft., TD 3,028 ft. Extends Clay City Consolidated field.

WILDCAT FAILURES COMPLETED IN ILLINOIS

Richland County: Pure 1 E. M. Hill, NE SE NE 14-3n-9e, east of the Noble pool, dry at 3,105 ft. Glen Dean 2,433 ft., Cypress 2,636 ft., Ste. Genevieve 2,967 ft., McClosky 3,009-12 ft.

OKLAHOMA

Interesting Showing in Caddo County Wildcat

THE West Edmond field in Oklahoma, Canadian, Kingfisher and Logan counties passed the 400 mark in the number of its Hunton lime oil wells last Saturday and most of the wells completed during the week showed a per well initial potential in excess of 2,000 bbl. per day. The field allowable is 150 bbl. per well per day. The smallest of the week's new wells flowed 319 bbl. in 12 hours.

Reservoir pressure in the Hunton lime zone in West Edmond field is declining at the rate of about 1 lb. per day according to the evidence shown by the two-weeks field tests conducted by engineers headed by Tom Bailey, petroleum engineer for the Corporation Commission of Oklahoma. Gas-oil rates are increasing in the east central part of the field. The allowable gas-oil ratio is 2,000 cu. ft. of gas to 1 bbl. of oil. Nearly half of the wells examined for gas-oil ratio were shown to be exceeding the allowable. Details of the field survey will not be available until the end of this week.

Henry Schafer Inc., may have made an important discovery south of the east end of the Cement field in Caddo County. The company's 1 Cook, NE SE NE 35-5n-9w, found the Medrano sand at 8,830-9,107 ft. and an electric log survey showed saturation from 8,860 to 9,107 ft., where water appeared. Drilling was continued with 9,200 ft. as the objective. The Schafer interests have about 7,000 acres of leases around the well. The Medrano sand in this well is about 3,000 ft. deeper than in the west end of the Cement field.

Continental Oil Co., 1 Dotson, SW NW NE 7-2s-3w, Bryan County, a wildcat, set pipe at 6,309 ft., on top of sand, total depth 6,487 ft., and after a shot and a cleaning out it swabbed 25 bbl. in 4 hours. Later it swabbed 125 bbl. in 13

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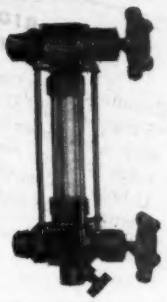

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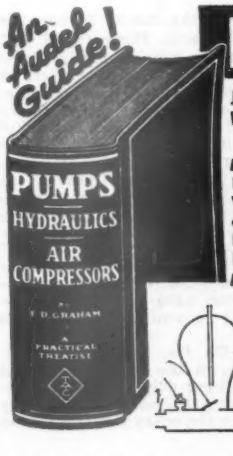

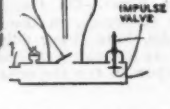

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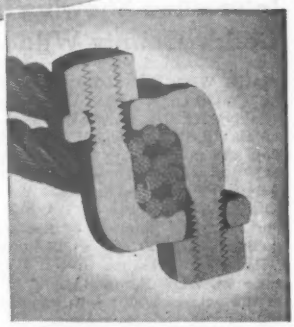

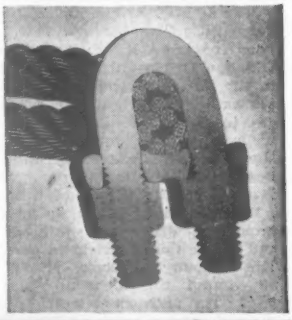

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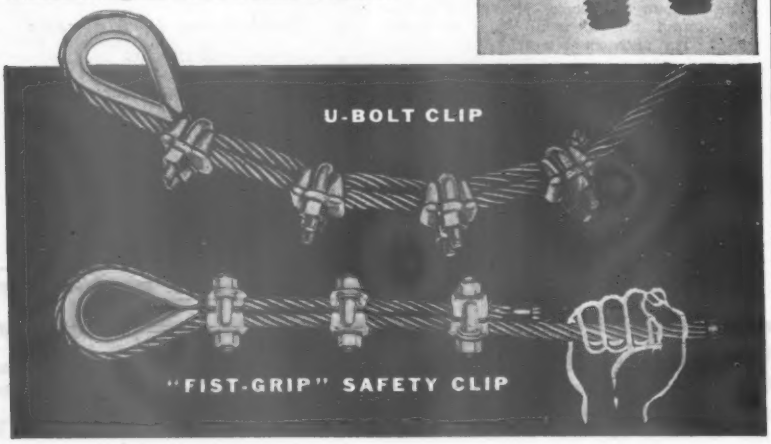

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hours, lowering the fluid level 600 ft. Testing was resumed.

Carter Oil Co. 1 M. T. Johnson, C SW NE 30-8n-2w, McClain County, offsetting the discovery well of the Goldsby pool, got water on the drill-stem test with two packers set at 8,231 ft. and 8,225 ft. The salt water rose 6,690 ft. The test was shut down.

Amerada Petroleum Corp., Gulf Oil Corp., and Magnolia Petroleum Co., 1 Williams, NE NE SW 27-6s-7e, which opened a pool in the Mead area of western Bryan County, was still being tested. It flowed 194 bbl. in 24 hours late in the week, the oil coming from the Bromide zone perforated at 2,910-30 ft., 2,965-3,005 ft., and 3,072 to 3,257 ft. Same companies have staked two locations on the Slaughter property in Section 27, one destined for the McLish and the other for the Bromide zone.

SUCCESSFUL WILDCAT COMPLETIONS IN OKLAHOMA

Logan County: W. Edmond Extension—Stanolind 1 Christner, SW NE 30-15n-4w, flowed 201 bbl. in 3 hours through ¾-in. choke from perforations in Bois d'Arc Hunton 6,862-86 ft., after 1,000 gal. acid wash, TD 6,928 ft., Bartlesville 6,533 ft., May 6,645 ft., Woodford 6,794 ft., Hunton 6,841 ft.

W. Edmond Extension: Phillips 1 Buetler "A", SE NW 31-15n-4w, flowed 390 bbl. in 16 hours through ¾-in. choke from perforations in Bois d'Arc Hunton 6,908-60 ft., after 1,000-gal. acid wash, tubing pressure 120 lb., casing pressure 400 lb., TD 7,002 ft., May 6,724 ft., Woodford 6,852 ft., Hunton 6,909 ft.

WILDCAT FAILURES COMPLETED IN OKLAHOMA

Creek County: Curtis Oil Co. 1 McGuire, NE SE NE 6-17n-8e, dry, TD 2,941 ft., Bartlesville 2,904 ft.

Noble County: Watchorn 1 Hirshman, SW NW NE 25-21n-1e, dry, TD 5,027 ft., Oswego 3,990 ft., May 4,637 ft., Woodford 4,824 ft., Viola 4,882 ft., Wilcox 4,960 ft., Second Wilcox 5,008 ft.

Payne County: V. L. Crowell 1 Price, SE SW NW 9-20n-4e, dry, TD 4,270 ft., Prue 3,505 ft., May 3,956 ft., Woodford 4,135 ft., Viola 4,160 ft., Wilcox 4,204 ft., Second Wilcox 4,240 ft.

Stephens County: Waggo Oil Co. 1 Johns, NE NE NE 11-2s-9w, dry, TD 4,478 ft.

Washita County: Sinclair Prairie 1 Bishop, NE NE NW 31-8n-19w, dry, TD 7,508 ft.

CANADIAN FIELDS

Northwest Extension Proven at Turner Valley

CHATHAM.—In the North Turner Valley extension area, Home Oil 18, LSD 7, 18-21-3w5, looks like a big producer from Madison limestone at 8,362-9,083 ft. Located farther west on structure than any north extension well, and considerably north and west of previous producers, the well cut a fault and went through three producing horizons in the limestone. The top zone produced high-gravity oil, similar to the naphtha found on the top of the structure to the south. As it was found impossible to produce this naphtha-bearing horizon and the crude oil from the two lower porous sections, the naphtha was temporarily shut off and the lower pays given 4,000 gal. of acid, developing initial production around 100 bbl. an hour.

Ram River.—On the Ram River-Clearwater structure, in the northern Alberta foothills, Ram River Oils 3, LSD 12, 1-37-11w5, is changing to heavy-duty rotary to deepen in the Devonian limestone from

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended Feb. 24, 1945					Cumulative total, 1945				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	4	4	0	0	3	11	14
Indiana	0	0	0	1	1	0	0	0	2	2
Illinois	1	0	0	1	2	10	0	0	39	49
Kentucky	1	0	0	1	2	2	0	1	9	12
Michigan	0	0	0	2	2	1	0	0	32	33
Kansas	0	0	0	3	3	5	0	3	61	69
Neb., Mo., Iowa	0	0	0	1	1	0	0	0	6	6
Oklahoma	2	0	0	5	7	15	0	2	40	57
Texas:										
North Central	6	0	0	12	18	20	0	2	71	93
West	0	0	0	13	13	4	0	0	48	52
Panhandle	0	0	0	0	0	0	0	0	1	1
Eastern	0	0	0	1	1	3	0	0	12	15
Gulf Coast	0	0	0	5	5	7	1	8	44	60
Southwest	1	0	1	6	8	3	0	3	35	41
Total Texas	7	0	1	37	45	37	1	13	211	262
Louisiana:										
Northern	0	0	0	3	3	0	0	0	12	12
Southern	0	0	0	1	1	4	0	0	6	10
Total Louisiana	0	0	0	4	4	4	0	0	18	22
Arkansas	0	0	0	2	2	0	0	0	12	12
Mississippi	0	0	0	3	3	1	0	0	16	17
Ala., Ga., Florida	0	0	0	0	0	0	0	0	3	3
Montana	0	0	0	0	0	2	0	0	3	5
Wyoming	0	0	0	1	1	5	0	0	5	10
Colorado-Utah	0	0	0	1	1	0	0	0	3	3
New Mexico	0	0	0	3	3	2	0	0	12	14
California	0	0	0	4	4	0	0	1	33	34
Total United States	11	0	1	73	85	84	1	23	516	624
Total previous week	13	1	5	63	82					

5,401 ft. Test has considerable gas at 4,362 ft. and has shown oil-saturated core from 5,311-5,401 ft.

Nordegg.—In the Nordegg area, northern foothills, Shunda Oils 1, LSD 15, 36-40-1w5, has a showing of green crude in Devonian limestone at 1,107 ft.

OHIO, KENTUCKY

Clinton Pays Off in Two Extension Operations

COLUMBUS.—The Middle Wellington pool was extended a location to the east by the Ohio Fuel Gas Co. 1 Myers-Witheck, Lot 5, Penfield Township, Lorain County. The Upper Clinton at 2,380-86 ft. gaged 1,950,000 cu. ft. The well will not be deepened to the lower sand until later.

The Natural Gas Co. of West Virginia found a show of gas in the Clinton sand in the deep test in Butler Township, Columbian County. The well is to be shot and tested.

C. A. Davis 1 Geo. McKee, Section 14, Jackson Township, Knox County, has been drilled in with 200,000 cu. ft. of gas and a good show of oil. The north half of Jackson Township now appears to be in a productive area.

In southeast Ohio, Wasson & Co. completed 1 Bell, a wildcat in Harrison Township, Muskingun County, at 4,228 ft. with an initial gage after shot of 3,000,000 cu. ft. gas from the Clinton sand and also about 30 bbl. of oil a day estimated from the Medina. The rock pressure was 1,080 lb. in 20 hours. This is about 2 miles from the nearest Clinton sand production although some Medina oil is within a mile of the Wasson well.

WILDCAT FAILURES COMPLETED IN OHIO

Holmes County, Knox Township: Ohio Fuel 1 J. Foeckler, Lot 9, Clinton 3,296-349 ft., TD 3,393 ft.

Morgan County, York Township: Industrial Gas 1-C Isaac Smith, Sec. 32, Clinton 4,015-30 ft., Medina 4,100-04 ft., TD 4,104 ft.

Summit County, Norton Township: J. C. Steiner 1 G. W. Auten, Lot 23, Clinton 3,750-828 ft., TD 3,850 ft.

Washington County, Decatur Township: Ohio Fuel 1 H. F. Dickinson, Sec. 23, Berea 1,846-49 ft., TD 1,926 ft.

EASTERN KENTUCKY OPERATIONS

ASHLAND.—Three gas wells and three dry holes marked operations in the Eastern Kentucky area during the week ending February 20.

Inland Gas Corp. completed 268 J. H. Hammons on Bull Creek of Licking River, Magoffin County, at 1,335 ft., with a daily open flow of 989,000 cu. ft. in Maxon, with a rock pressure of 400 lb.

Kentucky-West Virginia Gas Co. completed 773 Nelson Chaffins in Knott County at 2,630 ft., with daily open flow of 103,000 cu. ft. in shale, after shot.

Kentucky-West Virginia Gas Co. completed 5,568 Gilbert Martin in Knott County at 2,791 ft. with open flow of 520,000 cu. ft. in shale, after shot.

Three dry holes were noted by the Kentucky-West Virginia Gas Co., one at 3,280 ft. on the G. W. Hall land in Floyd County; one at 2,283 ft. on the G. W. Davis land in Johnson County, and one at 2,475 ft. on the Albert G. Wells land in Johnson County.

WESTERN KENTUCKY

OWENSBORO, Ky.—The St. Vincent pool in Union County was extended by Carter Oil Co. 3 Margaret Drury, which swabbed 578 bbl. initially from Levias lime and McClosky lime. Four wells were completed during the week in western Kentucky, three of them dry holes.

SUCCESSFUL WILDCAT COMPLETIONS IN WESTERN KENTUCKY

Union County: Carter Oil 3 Margaret Drury, 1-O-20, Levias lime 2,538-42 ft., and McClosky lime 2,550-58 ft., TD 2,564 ft. Acidized, swabbed 578 bbl. of oil in 24 hours. Extends St. Vincent pool.

WILDCAT FAILURES COMPLETED IN WESTERN KENTUCKY

Hardin County: Ohio 1 J. U. Gatton, 19-P-41, dry at 1,313 ft. Renault 26 ft., Ste. Genevieve 45 ft., St. Louis 235 ft., Osage 655 ft., Devonian 1,178 ft., Silurian 1,218 ft.

INDIANA

EVANSVILLE, Ind.—Six wells were completed in Indiana in the past week, three oil wells and three dry holes. The oil wells were routine completions averaging about 47 bbl. per well in initial production.

WILDCAT FAILURES COMPLETED IN INDIANA

Vanderburg County: Mohawk Oil et al 1 Oscar Riggs, NW SW NE 11-5s-10w, dry at 2,282 ft. Vienna 1,491 ft., Barlow 1,869 ft., Cypress 1,885 ft., Upper Renault 2,076 ft., Ste. Genevieve 2,131 ft., Levias 2,172 ft., McClosky 2,213 ft.

MISSISSIPPI

Marion County Test Flows 47.5 Gravity Oil

JACKSON, Miss.—Indications of a new field in Jefferson County, Mississippi, and proof of a discovery in Marion County, Mississippi, featured field reports from that state in a week in which nine field completions and two wildcats were completed.

Humble Oil & Refining Co. 1 M. R. Smith, C SE SE 12-9n-1e, gave encouraging showings in drill-stem tests in the Wilcox sand topped at 3,633 ft. and continued at intervals at 3,863 ft. Total depth was 4,042 ft. where Schlumberger test was to be made.

Humble Oil & Refining Co. 1 Evans, 660 ft. south and 1,980 ft. west of NE cor. 15-2n-18w, in Marion County, flowed 85 bbl. of 47.5 gravity oil in 19 hours through ¼-in. tubing choke on the last of a number of production tests. Plug was being drilled. The nearest oil production to this well is about 12 miles southeast in the Baxterville pool in Lamar County, which yields a heavy gravity oil.

A report from Savannah, Ga., says that Tropic Oil Co. 1 Gibson, 4½ miles south of Lyons in Toombs County, and 50 miles west of Savannah, showed oil in a Cretaceous formation at 2,178 ft. The report says the test will be drilled to the Tuscaloosa.

WILDCAT FAILURES COMPLETED IN MISSISSIPPI

Lauderdale County: Wanete Oil & Richard Lack 1 Beadles & Frederick, SW NE 32-7n-14e, elev. 452 ft., dry, TD 4,755 ft., Eutaw 2,820 ft., Tuscaloosa 3,185 ft., Massive sand zone 4,153 ft., Lower Cretaceous 4,683 ft.

Pearl River County: Hassie Hunt 1 Batson, NE SW 10-1s-14w, elev. 221 ft., dry, TD 9,074 ft., Tuscaloosa 7,188 ft., Marine Tuscaloosa 7,746 ft., Massive 8,407 ft., Lower Cretaceous 8,695 ft.

Sinclair 1 Batson, SE SE SW 20-1s-15w, elev. 282 ft., dry, TD 9,588 ft., Tuscaloosa 8,043 ft., Marine Tuscaloosa 8,428 ft., Massive 9,128 ft., Lower Cretaceous 9,313 ft.

WILDCAT FAILURES COMPLETED IN ARKANSAS

Dallas County: Lion Oil 1 Griggs, NW SE 23-10n-13w, dry, TD 4,632 ft.

Lincoln County: Killam & McMillan 1 Curl, NE SW 10-9n-5w, dry, TD 4,772 ft.

WILDCAT FAILURES COMPLETED IN NORTH LOUISIANA

Caldwell Parish: Placid Oil 122 La. Central, SE NW 16-11n-3e, dry, TD 7,682 ft.

De Soto Parish: Jarvis et al 1 Franklin, SW SE NW 6-11n-12w, dry, TD 2,827 ft.

Lincoln Parish: Big West Drlg. 1 Gill, NW SE 35-20n-2w, dry, TD 9,950 ft.

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Among the Drilling Contractors

Muskegon Development Co. is the contractor on the Gulf Refining Co. 1 Stevens Creamery Co., in SW SW SW 8-14n-6e, Bay County, Michigan. The contractor will drill on his own account the 1 A. Haefner, in NE NW NE 20-3n-13w, Allegan County, Michigan, and the 1 A. M. Proctor, in SE SW NW 3-12n-15w, Muskegon County, Michigan.

R. & S. Drilling Co. has been awarded drilling contract on the Dow Chemical Co. 21 Seath-Davy et al, in NE 34-18n-8w, Osceola County, Michigan.

Lupher Drilling Co. will drill on contract the Pure Oil Co. 2 Carney-Dahlberg, in C S½ NE NW 5-17n-10w, Osceola County, Michigan.

C. K. Dean is the contractor on the Fisher-McCall Oil & Gas, Inc. 1 W. R. Smith, in NW NW NE 8-16n-16w, Oceana County, Michigan.

Turner Drilling Corp. has been awarded contract to drill the Turner Petroleum Co. 1 Katherine Dietrich, in NW NW NE 35-12n-5e, Saginaw County, Michigan.

Fernando Drilling Co. is the name of a new firm that has been organized with headquarters at San Fernando, Calif., to engage in the contract drilling business in California. Organizers are Harry C. Long, R. R. Stone, and J. H. Stone. The firm will do contract drilling both to shallow zones and to depths of 9,500 ft.

M & G Drilling Co., Ltd., has been formed with offices in Alice, Tex. It will be operated under the personnel of Kirkwood & Morgan. H. J. Mosser and Joe Gleason, of Alice, will own the company which will lease the rigs to Kirkwood & Morgan.

Stephens Petroleum Co. has drilling contract on the Anderson-Prichard Oil Co. and Tide Water Associated Oil Co. 1 Scott Unit, in C NE NE 34-5n-8w, in the Chickasha pool, Grady County, Oklahoma, which was drilling at 3,293 ft.

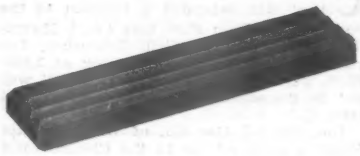
Creighton Drilling Co., contractor on the Ashland Oil & Refining Co. 2 Thlocco, in SW SE NW 30-7n-7e, Seminole County, Oklahoma, was drilling plug in the lower Calvin, at total depth of 1,918 ft.

General Petroleums, Calgary, has the contract to drill a joint test for McColl-Frontenac Oil Co. and British Dominion Oil & Development Corp. in the Eldon area near Pakowki Lake in the southeast Alberta Plains. Location is in LSD 9, 29-6-7w4, and will be one of a series of tests in a 22,129-acre block.

Hissom Drilling Co. has the drilling contract on the Cities Service Oil Co. 1 Ford, in NW SE SW 31-23-3w, Garfield County, Oklahoma.

C. R. Winn, contractor of Evansville, Ind., will drill the A. S. Mims 3 Roy Newman, in SW NE 36-6s-12w, Posey County, Indiana.

WEB WILSON Tong Dies



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MARKET QUOTATIONS

Prices as of February 27, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	5.875
Gulf Coast	6.75	5.825
Northeast Coast	...	9.075
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas (Dist. 1 Del.)	4.500	5.400
North Texas (f.o.b. plant)	4.375	5.250
North Louisiana (Dist. 1 Del.)	5.160	6.060
North Louisiana (f.o.b. plant)	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity.	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Texas
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended February 17, 1945

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks *Gasoline	Distillate	Residual
East Coast	722	13,279	5,473	4,903
Appalachian	157	4,303	493	471
Ill., Ind., Ky.	801	22,491	4,069	2,425
Okla., Kan., Mo.	392	9,064	1,811	1,159
Inland Texas	246	3,028	336	657
Tex. Gulf Coast	1,177	15,814	6,141	8,198
La. Gulf Coast	251	5,052	1,662	1,460
North La., Ark.	84	2,915	717	263
Rocky Mountain	114	2,129	344	654
California	843	16,605	8,818	28,050
Total 2-17-45	4,787	94,680*	29,864	48,240
Total 2-10-45	4,770	92,455	30,544	48,845
Total 2-19-44	4,441	83,302	33,914	52,694

*Civilian 49,265; Military 45,415.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of crude*
February 17, 1945	220,060,000
February 10, 1945	218,894,000
February 19, 1944	237,511,000

*Excludes unrefinable California stocks.

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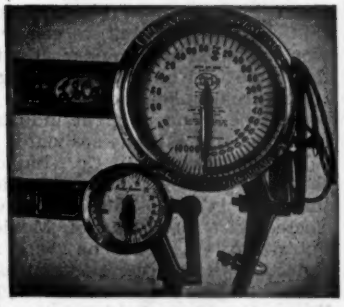

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PERSONALS

Saw "Golden Lane" Development at Close Range

E. G. McKEEVER, who assumed the presidency of Pan American Petroleum & Transport Co., Inc., American Oil Co., and affiliates on January 1, 1945, saw the development of the "Golden Lane," in Mexico at short range. He started his career in the oil industry in 1915 as secretary and assistant to the president of the Mexican Petroleum Co., a Pan American subsidiary, when it was taking a major role in making that spectacular spot a center of world interest and wonder. Right at that time fuel oil was beginning to replace coal under the boilers of big ocean liners and of great industrial plants on the Atlantic seaboard.

When Standard Oil Co. (Indiana) acquired control of Pan American Interests in 1926 McKeever was elected vice president of Mexican Petroleum Co., and he was advanced to the position of vice chairman after the reorganization in 1932. He continued to hold positions of responsibility and in 1937 was made executive vice president of Pan American, maintaining that post until his promotion to the presidency, to succeed Dr. Robert E. Wilson, when the latter was elected chairman of Standard Oil Co. (Indiana).

Alva W. Gorman, research engineer for Phillips Petroleum Co., has been transferred from Borger, Tex., to Bartlesville, Okla.

Frank E. Owens, district petroleum engineer for Humble Oil & Refining Co., has been transferred from the Stratton district, Kingsville, Tex., to the Scott and Hopper district, Encino, Tex. **Mark L. Weatherall** has been made district chief clerk of the Wasson district, Denver City, Tex.

S. F. Shaw, consulting engineer and specialist in the gas-lift method of producing oil, has rejoined Texas A. & M. College as professor of petroleum engineering. He plans to complete research started previously on the capacities of producing oil strings.

Isaac Doughton, assistant director of the petroleum division of Federal Economic Administration, has received a temporary assignment as the State Department's special petroleum attache for western Europe, and it was said he would leave Washington soon for Paris. The whole problem of supplying French civilians with petroleum products is under consideration.

Benjamin Miller has resigned as technical assistant to the director of Institute of Gas Technology, Chicago, to engage in consulting practice in New York. He will continue to serve the institute as a consultant.

John A. Hayes, formerly plant superintendent for Lone Star Gas Co.'s Wichita Falls district of distribution, has been promoted to superintendent of the shop department for the company's Dallas division of distribution. His former post has been filled by promotion of **Charles L. Rippy,** who was assistant distribution shop foreman in Dallas.

Allen Ehlers has resigned as district geologist at Seminole, Okla., for The Carter Oil Co. to engage in consulting work.

John L. Hart, until recently flight instructor at the U. S. Army Air Forces basic training school at Ballinger, Tex., has joined Skelly Oil Co. as scout at Midland, Tex.

Byron Rife, formerly an independent oil operator in Texas, Oklahoma and Kansas, has been promoted to full colonel and is commanding officer at U. S. Army ordnance plants at Joliet, Ill.

Fred Lichtenheld, petroleum engineer in Oklahoma City for Cities Service Oil Co., is in charge of a school in drilling and completion of wells, opened at Bodine camp for company employes in the Oklahoma City district. The students, meeting semiweekly, will be taken through every step in construction, drilling, testing, completion and final gaging.

E. W. Scudder, for 23 years on the geological staff of Gulf Oil Corp., has resigned to head the land and geological office of J. M. Huber Corp., Denver, Colo.

Dr. F. W. Breth and **Gustave Schindler** have been elected vice presidents of L. Sonneborn Sons., Inc., oil refiners and manufacturers, New York. Dr. Breth, who will be in charge of manufacturing, joined Sonneborn in 1915 as chief chemist and later was named technical director. He has developed many products and refining processes. Schindler, starting his business career in 1928, operated a group of refineries which manufactured specialized petroleum products similar to those made by Sonneborn. Recently he has served as president of Petroleum Specialties, Inc., New York, which he founded in 1939. Sonneborn operates two refineries in western Pennsylvania and one in New Jersey.

C. P. Parsons, director of materials, Petroleum Administration for War, has returned to Washington following an inspection tour of 6 weeks in oil fields of Trinidad, Colombia, Venezuela, and Dutch West Indies. Parsons said that with materials for oil activities in this country supervised in his office, much red tape has been eliminated and closer cooperation is developing.

William F. Thiede, formerly assistant manager of the New Jersey works of Standard Oil Co. of New Jersey, has been advanced to manager, succeeding the late G. H. Mettam. Thiede has been with the company 33 years.

Dr. T. L. Bailey, research geologist for Shell Oil Co., Inc., in the Houston office since 1936, has been transferred to California.

Lt. C. R. Toner, member of Sun Oil Co.'s refinery laboratory staff at Marcus Hook, Pa., before he entered war service, has been awarded the Air Medal. In addition to this honor, the bomber unit of which he

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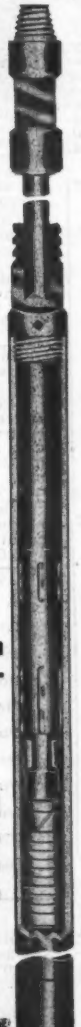
TYPE G



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is a member, has received the Presidential Citation for extraordinary heroism in battling through terrific antiaircraft fire for effective bombing of important objectives in Germany, one of them an aircraft plant. He pilots a flying fortress.

S. M. Griffith, A. F. Brough, J. R. Keane and **C. W. Powell,** of Los Angeles, and **G. R. Daley,** of San Diego, have been elected directors of Western Asphalt Association, at the annual meeting. All officers were reelected.

Theodore G. Glass, geologist for Sinclair Prairie Oil Co. in the Oklahoma City district for the past 3 years, has been made district geologist in the Panhandle district.

Roy F. Deck has resigned as superintendent of production for The Shamrock Oil & Gas Corp. in the Moore County field to join Harry Steckel Producing Co. as superintendent of its operations in the Panhandle of Texas. **Frenk H. Stone,** who was chief engineer for Shamrock, has been employed in the same capacity by La Gloria Corp. at Corpus Christi, Tex.

H. G. Denham has been appointed manager of sales for Arabian American Oil Co. A graduate of Brown University, Denham joined Standard Oil Co. of California in 1927 after serving in the oil distribution business in China 11 years. He became assistant manager of Standard's foreign trade department and in 1943 was named president of California Commercial Co., a Standard of California subsidiary. Arabian American headquarters are in San Francisco, but Denham will spend much time at the company's New York offices.

Clyde H. Britten, formerly assistant manager of the Wilmington, Calif., refinery of Shell Oil Co., Inc., has been transferred to the headquarters office of the company in San Francisco, where he is manager of the technical applications committee.

CALENDAR

April

I.P.A.A., midyear directors meeting, New Orleans, La., April 16-18.

June

Canadian Gas Association, annual convention, Manoir Richelieu Hotel, Murray Bay, Quebec, June 19-22.

October

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 4-6.

I.P.A.A., annual membership meeting, convention city to be selected later, October 15, 16 and 17.

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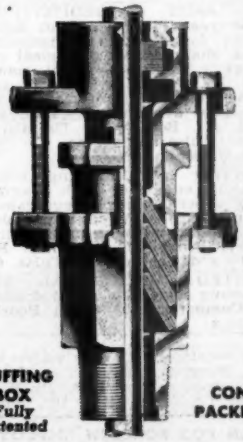

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Applications solicited from men not now employed in essential work or those completing essential work who have Statements of Availability

ARTHUR G. McKEE & CO.
2300 Chester Avenue
Cleveland, Ohio

HELP WANTED

Construction superintendent with general field experience in supervising and organizing large petroleum refinery or equivalent project. Write references, salary. Foster Wheeler Corporation, Construction Department, Carteret, New Jersey.

GEOLOGIST or GEOPHYSICIST with several years experience in field gravity surveys; for research computation, interpretive analysis and geological correlation of gravity data. Major oil company engaged in expanding gravity exploration program. Give full information education, experience, availability status, salary expected, etc. Box A-420, The Oil and Gas Journal, Tulsa, Oklahoma.
Delafield, Wisconsin.

WANTED by consulting organization: Petroleum engineers with Hayward mud logging experience or its equivalent. Immediate openings in Venezuela, excellent opportunity for advancement to managerial positions throughout the world. Box A-290, The Oil and Gas Journal, Tulsa, Okla.

WANTED: MECHANICAL ENGINEER who knows something about drafting. John Zink Company, 4401 South Peoria, Tulsa, Oklahoma.

DRILLERS

Steady work, good wages water wells year round, Bucyrus machines, essential to war effort, draft exempt. Apply—Gray Well Drilling Co., Inc., Box 181, Phone 1051.

MEN FOR FOREIGN EMPLOYMENT
in Saudi Arabia

Refinery operators; petroleum, electrical and mechanical engineers; radio operators and technicians; Diesel and tractor mechanics; air-conditioning and refrigeration mechanics; stabilizer operators; utility operators; surveyors; boilermakers, pipefitters, and various other crafts; accountants; stenographers; typists.

Employment offers opportunities for post-war security and advancement. Liberal benefit plans; vacations in United States; free hospital and medical care.

If genuinely interested in foreign career, send full information on experience, transcript of college record (professional applicants only), references, draft and availability status to our Employee Relations Department.

ARABIAN AMERICAN OIL COMPANY
200 Bush Street
San Francisco 4, California

HELP WANTED

COMPRESSION TYPE GASOLINE PLANT FOREMAN: Independent concern in Southwest wants man experienced in compressor and natural gasoline stabilizer operation and maintenance to take responsible charge of plant operation. Salary open. Give full details as to experience, personal data, salary desired, and references. Will interview if favorable. Position open now. Box A-445, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: By Inland Texas Refinery. Shift Foreman for Combination Dubbs Cracking and Skimming Plant manufacturing asphalts, cracked gasoline and side-cut naphthas. Permanent job for right man. Box A-447, The Oil and Gas Journal, Tulsa, Okla.

WANTED: EXPERIENCED REFINERY SUPERINTENDENT for Gulf Coast refinery. Preferably chemical engineering background with Dubbs or Kellogg cracking plant experience. In application state age, experience, education, training, salary expected, when available. Statement of availability required. All replies confidential. Box A-426, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMISTS—ENGINEERS
PHYSICISTS

Men interested in careers in industrial research are urged to write us giving details of training and experience. Essential work with promising postwar future offering opportunities for professional growth.

BATTELLE MEMORIAL INSTITUTE
COLUMBUS 1, OHIO

Ashland Oil & Refining Company,
Ashland, Kentucky
WANTS
DESIGNING DRAFTSMAN

With experience in oil refinery and power plant piping, pressure vessels and heat exchangers. Independent company with completely integrated operations and a large output of 100 octane gasoline. Due to postwar program this position offers excellent opportunities for the future.

Address all correspondence to Employment Department. Applicants must comply with War Manpower Commission Regulations.

SITUATIONS WANTED

CHEMICAL Engineer: Several years Refining and Recycling Plant experience as Process Engineer. Also experimental and research laboratory work. Plant design, operations, super fractionation, alkylation, fluid catalytic cracking. Box A-443, The Oil and Gas Journal, Tulsa, Oklahoma.

HIGH-CLASS Man, Age 47, married, no children, two years college, desires permanent position with progressive independent. Presently employed as Office Manager-Auditor large Texas producer—Salary $350. Betterment only reason for change. Box A-441, The Oil and Gas Journal, Tulsa, Oklahoma.

16 YEARS experience on topping, combination, coking, reforming and fluid catalytic cracking. Prefer position in mid-west or west. Can furnish statement of availability. Box A-446, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES OR SERVICE engineer oil tools or equipment. 20 years field and sales experience. Wide knowledge and acquaintance Mid-Continent, Gulf Coast and California. Sober, industrious, and can fit into your organization. Available immediately; draft status 4-A. Box A-456, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GRADUATE GEOLOGIST: Age 27, has B.A. degree in geology, is single, in excellent health, and draft deferred at present, desires position as junior geologist with major or progressive independent company. Would prefer surface interpretative work in the Appalachian geosynclinal area. At present employed in seismic prospecting. Available thirty days after acceptance. Box A-429, The Oil and Gas Journal, Tulsa, Oklahoma.

TWENTY years, experience in operations, topping, cracking, gas compression and recovery, light ends fractionation, light and heavy treating. Have statement of availability. Box A-365, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPETENT, Reliable man. Twenty-five years experience as Drilling Superintendent on cable tools wishes position with reliable company or firm. Details and references on inquiry. Box A-436, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED BUYER, A-1 references, desires connection with major, independent, distributor, group or inrividual, as lease or royalty buyer in Florida and Georgia where many majors have bought. Box A-435, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent, 47, now employed with over twenty years field experience—production, drilling and workovers, an engineering graduate, sober, industrious and capable, desires affiliation with Mid-Continent concern where he can be kept busy. Box A-448, The Oil and Gas Journal, Tulsa, Oklahoma.

TRAINED Oil Business Manager. Educated and experienced in oil and gas lease development and operation, pipe line, gasoline plants, refining and marketing. Interested in salary with business opportunity to help direct your business. Box A-183, The Oil and Gas Journal, Tulsa, Okla.

EXPERIENCED LANDMAN, ex-service man, wants permanent connection with substantial oil company or independent operator. Address Box A-187, The Oil and Gas Journal, Tulsa, Okla.

GEOLOGIST AND LANDMAN: Has B-S. Degree; subsurface and lease experience in central United States, Rocky Mountain Area and Appalachian Region. Desires position in domestic or foreign work. Available now. Box No. A-450, The Oil and Gas Journal, Tulsa, Oklahoma.

ACCOUNTANT, oil drilling, refining and production experience. Some public accounting experience. Box A-451, The Oil and Gas Journal, Tulsa, Oklahoma.

A forty-five-year-old Executive with twenty years of successful experience in handling Labor and Public Relations and problems of Personnel, Medical Aid, in Plant Feeding and Plant Safety Security and Fire Protection in Oil Refining and Chemical Plants is contemplating a change from his present position. Box A-431, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT FOR SALE

FOR SALE: At Chase and Russell, Kansas, 3—O.C.S. Timken Bearing Single Brake, Chain Driven Sand Reels Less Chain, $350.00 each. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE: One Fort Worth Spudder, model D, complete with tools, light plant, shear poles, just completed 1,600-ft. well. C. R. Nish, Yates Center, Kansas.

WAR SURPLUS

1,500 Watt, 110 volt AC Onan Plants, like new in original crates. List Price $410.00, offered at $225.00, each.
Also twenty-four larger gas and Diesel plants up to 60 KVA. Fine for chicken hatcheries, creameries and other standby service.

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